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ELECTRICAL WORLD

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June 23, 1934

Network or Radial Distribution?

A new and highly practical approach to one of the most important problems facing utility engineers and executives today

Electrical Layouts for Production Economy

Industrial plants are revamping whole processes and departments these days to take advantage of electrical aids to lower costs

How We Evaluate Rate Changes

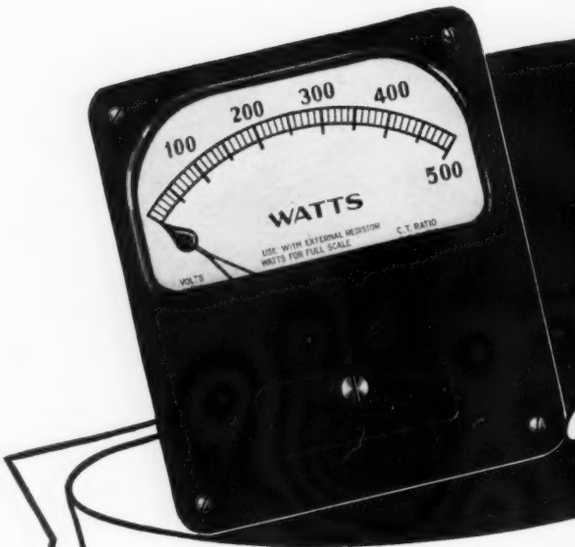
This utility makes it a point to *know* what the effect of proposed rates will be and the man in charge tells how it is done

Interchange Benefits Utility and User

Flexibility of power and heat services in combined operation of industrial and utility plants proves advantages early in contract life

Practical Intake Designs for Small Hydros

Pioneering installations require departures from standard practices and this typical solution points to opportunities for improvement



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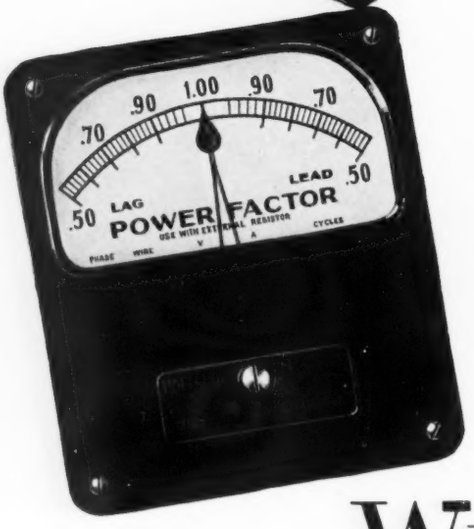

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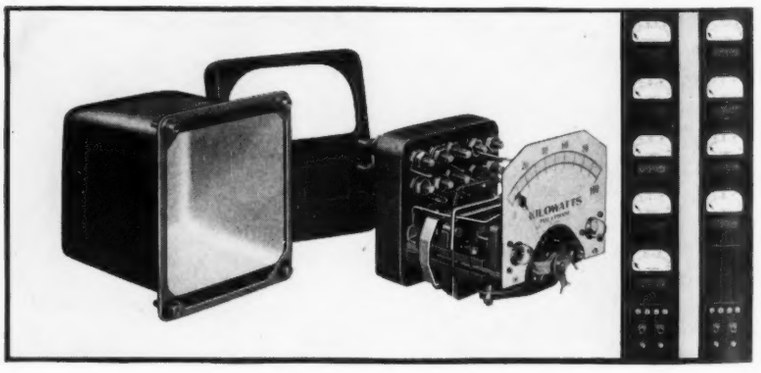

WESTON *Instruments*

NRA

ELECTRICAL WORLD

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3 Reasons for modernizing your G-E breakers by adding oil-blast

WHEN you modernize *some* equipment — transformers, for example — the savings can readily be figured. The cost may be returned in six months, or in a year, or longer.

In the case of breaker modernization, the savings are indeterminate; yet a modernized breaker may pay for itself in a tenth of a second. Within this short period it may clear a heavy short circuit that would have damaged the equipment which the breaker is intended to protect.

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Our switchgear specialists will give you detailed information about adding oil-blast action to the breakers on *your* system. Consult them at our nearest office, or write General Electric, Schenectady, N. Y.

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GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1874—McGraw-Hill Publishing Company, Inc.

for the Week Ending

June 23, 1934

L. W. W. MORROW, *Editor*

Attitude and Leadership Will Win

IN THE admirable address of George B. Cortelyou before the recent Edison Electric Institute convention at Atlantic City there was much to which the electric light and power industry should give sustained attention. His suggestions not only should be considered but acted upon. Despite their preoccupation with current difficulties, the higher executives of the industry face the necessity of devoting time and thought to major industry problems and the path ahead. They must continue to keep the public aware of their industry as a continuous contributor of new and impressive accomplishment; they ought to present the case of the utilities so that hostile attacks, unfair regulation and discriminatory taxation will not handicap progress, and they will have to change their policies and practices to meet the new conditions.

All in the light and power industry must have the courage to go ahead, to contribute constructive measures to national recovery and to carry to the public the reflection of an optimistic and aggressive attitude. In the words of Mr. Cortelyou, "Whatever the obstacles in our path, we shall go forward with resolute determination to make the industry as great in leadership as it is in technical strength, to protect and defend its legal and constitutional rights against unjust aggression, to promote the widest possible use of its service at the least possible cost to every class of consumer, doing our work as well as we know how, striving always for further improvement."

One of the first tasks of leadership is to get loyalty and enthusiasm within the ranks of the industry. This can be done in the power industry, but the venom of newspaper and political attacks must be counteracted, a thorough understanding of the complicated situation must be acquired by executives and an intelligent campaign for the promotion of the industry to its membership should be inaugurated. Just as disorganization followed when all internal informational channels dried up as a natural reaction to the self-glorification of the public relations structure that collapsed during the depression, so the establishment of wisely planned co-ordination of informational channels, personal contacts and interchanges of ideas in a conscientious program for morale and loyalty building will build back that which was lost. This is the first and most important task for industry leaders to undertake and carry through to a finish.

ANOTHER problem in leadership, almost as important, is to sell the industry to the public. No excuse is valid for avoiding this necessity and this obligation. It should be done as a local sales task by each operating property. Only as a cumulative effect of this work over a period of years will national public sentiment become more favorable to the utilities. And this sales task is difficult. It requires honesty of purpose and specialized knowledge and skill. Material for newspapers and the radio must be highly special and must be supplemented by the work of executives and employees that is sincere, honest and directive. The attainment of good public relations is an art at which the utilities have proved particularly inept in the past, but it is one in which they must display proficiency if the hope for justice and further contribution to the public welfare is to flourish.

The problems of the industry are largely psychological. They are far from fundamental as threats to its material progress, for the possibilities for expanding electric service are enormous. There is every reason, therefore, for industry leaders to act at once in an enthusiastic endeavor to create a more favorable psychological environment.

A Well-Deserved Award

In designating the Hartford Electric Light Company as recipient of the Charles A. Coffin Award the Edison Electric Institute picked a cynosure. Actually, the award was based on 1933 accomplishments which were, however, only a bit more outstanding than the long chain of successful pioneering ventures in the régimes of A. C. Dunham and S. G. Dunham, who preceded Samuel Ferguson in the presidency.

Consistently and persistently a local enterprise, in the face of maneuvers to bring it into the fold of a holding company, this unit enjoys unusually good relations with its public. That mutual relationship was much strengthened last year by the accommodating manner in which delinquent customers were handled by credit certificates. The dividend to customers had been a welcome feature of previous years, but the allocation last year was applied to a definite rate reduction; it served admirably its purpose as a cushion. Meanwhile, the employee pay had not been reduced and the dividends were maintained in full to the stockholders. Range rentals, farm electrification campaigns and steady pressure to make homes all-electric (there are now 750 of them) are features of a broad service and good will program.

Over the years Hartford has been first in technical innovations too numerous to recount, most notably the pioneering with the mercury turbine. Of late the eyes of the industry have been directed toward this Connecticut company because of its commercial inventions. They will continue to watch in the expectant mood of "I wonder what Ferguson will do next?"

Good Business Sense

Solving the profit problem of the electric power business is in principle as simple as in any other commercial enterprise. Net profits come from earnings on sales to customers. More sales bring more earnings. There is only one way to increase volume, and that is to sell. Here is the A B C of it. With adversity men gradually get down to these fundamentals.

There is a good example in the present range activities of the Public Service Company of Northern Illinois. For years, like so many other central stations allied with gas interests, this company avoided the development of domestic cooking load. Now, under the sharp urge of necessity, in the form of a commission order for rate reduction, it has broken these restrictions. It is selling ranges with all the campaign aids and pressures of advertising, specialty salesmen, sales training schools and pep talks.

Here is the singleness of purpose that must dominate any successful business. It declares that every economic use of electricity that performs a service is legitimate. It opens opportunity full wide. It builds load that makes the domestic consumer really profitable.

High Cost Fuel Opens Markets

A large increase in the price of coal and oil makes it economical to modernize many fuel-burning power stations. The cost of fuel is a very large part of the cost of power, so that economy in the use of fuel may be capitalized upon readily when fuel prices are high. In the light and power industry as a whole the fuel economy is about 1.5 pounds of coal per kilowatt-hour, but there are hundreds of old plants that use 2 pounds or more per kilowatt-hour. Only the bulk output of the few large and modern stations recently built makes possible the low average fuel use.

Fortunately, technological developments make it possible to modernize the many small power stations that use too much fuel. The simple boiler-turbine-generator unit today can be installed in an old plant for from $50 to $75 per kilowatt, and this adds a very small capital charge increment in comparison to the dollars saved on the fuel bill. It will pay utilities and equipment manufacturers to survey these possibilities.

Still another angle to the situation is the effect on private industrial plants. With greatly increased fuel prices, the market is opened for utility service and the abandonment of the industrial plant, or, as an alternative, the utilities might well consider placing new capacity in the industrial plants to care for these loads and loads in the adjacent areas. The economy of the multiple generating plant as contrasted with the single large generating plant is becoming greater each year.

High-priced fuel thus opens new markets, makes possible the modernization of old plants, points to departures in system plans and policies and introduces favorable conditions for more hydro station developments. The increased cost of fuel is the most significant happening in the power business and should be measured carefully. Conclusions made should be applied at once.

How We Evaluate Rate Changes

With Comprehensive Customer-Bill-Use Statistics Available

Pre-Reduction Studies Foretell Probable Revenue

By HUGH M. LEAMING

Public Service Company of Northern Indiana, Indianapolis, Ind.

Very little has been written on the use of customer statistics for evaluating rate changes. But only by an analysis of experience in serving consumers can management estimate accurately the probable effect of new rate schedules. Here is one good way to do it. Mr. Leaming writes out of an experience of seven years in which he made such studies a major part of his work.

IT IS the general policy of the rate department of our company to analyze twelve months' consumptions of all customers involved in any contemplated rate change. In several cases of residential lighting analyses we have taken every second or fourth account as appearing in the meter books and the results have been satisfactory. However, the analysis of all accounts insures accuracy and improves the value of the work as evidence in rate proceedings.

We use two general methods—the customer method and the bill method—which are applicable to electric, gas and water customer statistics. The general principle of either method is to split all consumptions, or bills as termed in this article, into rate blocks and then apply unit prices.

With the customer method the rate blocks needed are predetermined and then the consumptions are split by accounts. The following example shows the application of this method to one customer and the results of such an analysis on all the residential accounts in a town of 2,200 customers:

Account of John Doe:

Kw.-Hr. Cons.	Minimum Bills No.	Bills Cons.	First 25	Next 5	Next 5	Next 15	Next 10	Next 10	Over 70
10	1	10	...	..	..	...	..	..	..
14	..	..	14	..	..	...	..	..	..
20	..	..	20	..	..	...	..	..	..
40	..	..	25	5	5	5	..	..	..
76	..	..	25	5	5	15	10	10	6
100	..	..	25	5	5	15	10	10	30
104	..	..	25	5	5	15	10	10	34
120	..	..	25	5	5	15	10	10	50
110	..	..	25	5	5	15	10	10	40
60	..	..	25	5	5	15	10	..	..
40	..	..	25	5	5	5	..	..	..
26	..	..	25	1	..	..	..	..	..
720	1	10	259	41	40	100	60	50	160

Total Town of 2,200 Customers:

914,746	3,344	21,800	514,608	66,428	50,405	100,651	39,344	26,578	94,932

Such an analysis makes it possible to apply a number of trial rates to the town quickly and easily. For example, the following rates might be set up:

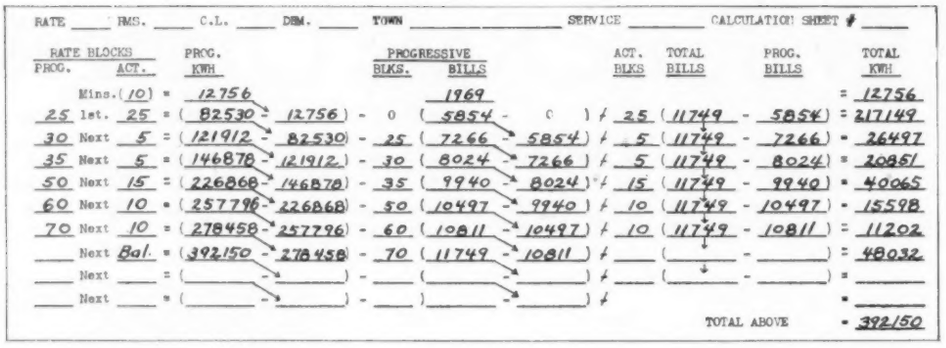
Rate 1		Rate 2	
25 kw.-hr.—514,608 at 9¢ =	$46,314.72	35 kw.-hr.—631,441 at 8¢ =	$50,515.28
25 kw.-hr.—217,484 at 6¢ =	13,049.04	35 kw.-hr.—166,573 at 6¢ =	9,994.38
Balance —160,854 at 3¢ =	4,825.62	Balance — 94,932 at 3¢ =	2,847.96
Min. Bills— 3,344 at $1 =	3,344.00	Min. Bills— 3,344 at $1 =	3,344.00
	$67,533.38		$66,701.62

The effect of changing the unit cost of any rate block is apparent at a glance. After final determination of the rate, it may be necessary to make a correction on the minimum bills if the kilowatt-hours allowed for the minimum bill is different from the preliminary allowance. In determining the desired consumption blocks, we always make provision for obtaining the present rate revenue. A comparison of the total kilowatt-hours analyzed and the reconstructed revenue with the statistical totals affords a valuable check on the accuracy of the work.

The bill method does not require a predetermination of the rate blocks. The first step is to prepare a tabulation of all the bills, similar to the one partially shown in the table on page 900. The progressive totals are subtotals of bills and kilowatt-hour consumptions.

Use of the form shown in Fig. 1 was devised by the writer to resolve the tabulation totals into consumption blocks. The desired rate blocks and the corresponding progressive rate blocks are inserted in the proper columns. Then progressive bills and kilowatt-hours are taken from the tabulation for each progressive rate block and repeated as indicated by the arrows. To calculate the consumption blocks, as in algebra, first, clear the parentheses; second, perform the indicated multiplications, and third, obtain the net total. With a little practice, any one can fill in and work these forms rapidly.

In case it is desired to provide for analysis of room basis or other demand form of rates, it is necessary to prepare a tabulation of bills for each size of house or demand. In preparing tabulations for commercial lighting on a connected load or demand basis, we find that no



RATE ____ RMS. ____ C.L. ____ DEM. ____ TOWN ____ SERVICE ____ CALCULATION SHEET # ____

RATE BLOCKS PROG.	ACT.	PROG. KWH		PROGRESSIVE BLKS.	BILLS	ACT. BLKS	TOTAL BILLS	PROG. BILLS	TOTAL KWH
Mins.	(10)	= 12756			1969				= 12756
25	1st. 25	= (82530 - 12756)	- 0	(5854 - 0)	÷ 25	(11749	- 5854)	= 217149	
30	Next 5	= (121912 - 82530)	- 25	(7266 - 5854)	÷ 5	(11749	- 7266)	= 26497	
35	Next 5	= (146878 - 121912)	- 30	(8024 - 7266)	÷ 5	(11749	- 8024)	= 20861	
50	Next 15	= (226868 - 146878)	- 35	(9940 - 8024)	÷ 15	(11749	- 9940)	= 40065	
60	Next 10	= (257796 - 226868)	- 50	(10497 - 9940)	÷ 10	(11749	- 10497)	= 15598	
70	Next 10	= (278458 - 257796)	- 60	(10811 - 10497)	÷ 10	(11749	- 10811)	= 11202	
____	Next Bal.	= (392150 - 278458)	- 70	(11749 - 10811)	÷ ____	(	-)	= 48032	
____	Next ____	= (____ - ____)	- ____	(____ - ____)	÷ ____	(	-)	= ____	
____	Next ____	= (____ - ____)	- ____	(____ - ____)	÷			= ____	
							TOTAL ABOVE	= 392150	

Fig. 1—Form used to resolve tabulated bills into consumption blocks

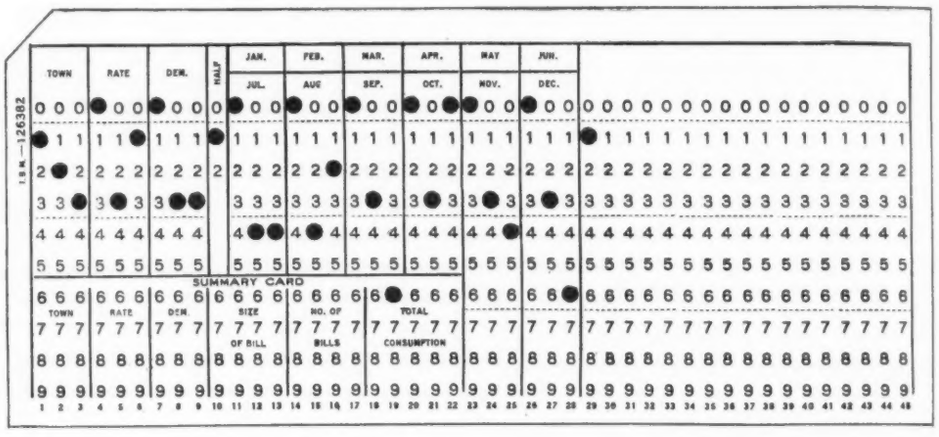


Fig. 2 — Punch card used with tabulating equipment

appreciable error is introduced by taking the nearest one-half kilowatt of demand. The tabulations can be prepared rapidly by a hand tally method, especially on residential accounts. If there is a sufficient volume of accounts, tabulating equipment can do the work faster and more satisfactorily, particularly if it is desired to analyze demand form of rates. Tabulating equipment was used under my direction to analyze 200,000 customers in 250 towns, with more than 200 different rates in effect. This work required approximately nine months and the results were very satisfactory.

Two cards were punched (Fig. 2) for each customer, showing town and rate codes, demand and consumptions, as indicated by the upper headings. The sorting and tabulating machines then prepared six preliminary tabulations without progressive totals for each pair of months from which summary cards using the lower headings were punched. The summary cards were then used to prepare tabulations with progressive totals, by demands and rates for each town, by groups of towns, and finally for the entire company. Several manufacturers rent this tabulating equipment to their cusomers. It is also possible to have the tabulations prepared by other companies on a contract basis.

The customer method makes it possible to determine the number of customers increased and decreased on an annual basis. It works better when the rate blocks are known in advance. It is the preferable method in applying optional rates. The bill method is often the quicker and more economical way. It allows unlimited choice of rate blocks and is very satisfactory as long as non-optional rates are applied. However, it gives unreliable results with optional rates due to the seasonal variation in consumption.

Tabulation of Residential Lighting Bills

Size Bill Kw.-Hr.	Number Bills	Kw.-Hr. Consumption	Progressive Totals—Bills	Progressive Totals—Kw.-Hr. Cons.
0	181	0	181	0
2	157	314	338	314
4	264	1,056	602	1,370
6	340	2,040	942	3,410
8	462	3,696	1,404	7,106
10	565	5,650	1,969	12,756
12	519	6,228	2,488	18,984
24	517	12,408	5,854	82,530
26	524	13,624	6,378	96,154
28	441	12,348	6,819	108,502
30	447	13,410	7,266	121,912
32	403	12,896	7,669	134,808
34	355	12,070	8,024	146,878
36	351	12,636	8,375	159,514
50	174	8,700	9,940	226,868
60	86	5,160	10,497	257,796
70	55	3,850	10,811	278,458
372	1	372	11,749	392,150

Tooth Harmonics Lowered by Staggering Pole Pieces

Telephone interference from the lines of the city of Los Angeles Department of Water and Power in the San Fernando Valley several years ago caused troublesome interference at the seventeenth and nineteenth harmonic frequencies. The trouble was traced to three 9,375-kva. waterwheel generators at the department's No. 1 plant in the San Francisquito canyon and was corrected at a cost of less than $200 a unit by the combined efforts of the department's engineers, the manufacturer and the repair and test divisions of the Bureau of Power and Light. The trouble was corrected at the source by staggering the keys in the pole pieces.

The machines have nine teeth per pole and unity winding pitch, so the disturbing frequencies were attributed to "tooth harmonics" and necessitated a 10-deg. reduction in winding pitch for its elimination. The minimum reduction by chording would have been 20 deg., of negligible assistance in reducing the troublesome frequencies. Other methods suggested were: (1) Filters at the power house, (2) resonant generator shunts, (3) shaving the

pole faces to make armature windings gradually enter the pole flux, or (4) to skew the pole pieces to accomplish the same effect. All of these methods were discarded as too expensive or endangering the strength or characteristics of the machine. The scheme finally adopted was to stagger the pole pieces to give the effect of fractional pitch windings.

Alternate poles were shifted by keying to the opposite side of the original dovetail openings and the remaining poles were turned end for end and keyed to the original sides of the openings. The original keys were of such width that this method gave a 10.6 deg. shift to the poles, which was found to be sufficiently close to cut down the interference to within allowable limits of telephone practice. The pole shift in these machines was performed along with a rewinding of the armature and reinsulation of the field coils, making the total additional cost of eliminating the troublesome harmonics less than $200 per unit.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Neal and hope others will discuss industry questions here in a similar constructive vein.

George A. Neal takes—

Vice-President, General Manager
Iowa Public Service Company

A realistic view of the necessity for action in the operation of power properties

It requires something more to win a battle than just the ability to take punishment.

Certainly the industry should continue to show, as it has in the recent past, that it "can take it." The people know that they are bearing down hard and are probably getting more than a little vindictive satisfaction out of the situation. And they expect us to act like the good ball player who occasionally draws down on himself the razzing of the crowd, but keeps his temper and cheerfully keeps plugging away until the storm blows over. In other words, the people expect us to exhibit the maximum of good sportsmanship.

But it takes more than good sportsmanship alone to make a winner. The winner has got to *do* as well as *be* if he is to win. It seems to me that one of the things for the industry to do is tend to its knitting by minding its business better than it has before. When I say the industry should mind its business I do not mean minding in the common use of the word, as simply paying attention to one's own immediate affairs exclusively. I mean the industry should mind its business in the sense of putting a lot of good hard work into improving it. I can mind my own business by not sticking my nose into other people's business. But that is not enough. I must do that and, as well, I must mind my business by taking care of it and making it grow.

To lift the curse of the politicians who say that it is a huge "Power Trust," the industry should prove that it is a local enterprise in each community. Is it necessary to tell intelligent men how this is to be done? We all know how to do it, but few of us have taken the trouble to do it right. To this purpose to some extent, but more specifically for the greater sale of its service, the industry in its individual units should advertise on a larger scale than ever before. All advertising should be definitely local in character, with "canned ads" shunned like the deadly upas tree.

And when the wind dies down we shall find on our hands a bigger job than ever before. All this talk of expanding electric consumption to such figures as 1,000 to 2,000 kw.-hr. per home per year will come true, I believe. But we shall probably have to discover how to live and make a profit on the good old average bill of $3 a month, because I doubt that the average residence will ever yield more than that regardless of the kilowatt-hours used.

Italy Electrifying Rapidly

Electrochemical and electrometallurgical industries in Italy used nearly 28 per cent of all the energy delivered to ultimate consumers during 1932. Domestic lighting accounted for 10 per cent.

With respect to the latter item a parallel may be drawn with conditions in the United States, for the number of such customers in Italy dropped from 5,297,707 in 1931 to 5,231,366 in 1932 and their energy consumption from 684,187,000 kw.-hr. to 667,721,000 kw.-hr., against our decrease of 0.8 per cent in their number and 0.2 per cent in the consumption, although other uses caused the Italian total to rise 1.3 per cent.

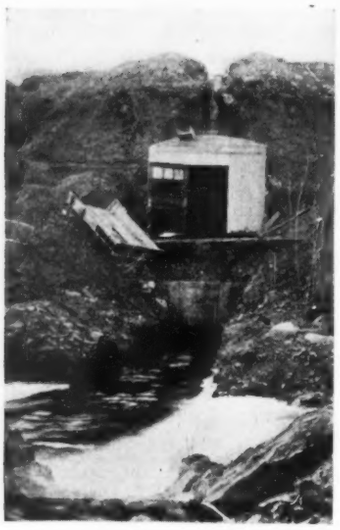
Based on the census of 1931, which indicated a population of 41,651,617, the consumption per capita in 1932 was 203 kw.-hr. if electrochemical use is included and 146 if it is omitted. In the United States the output of public utility plants is about equivalent to 700 kw.-hr. per capita, but this figure is not directly comparable with those given for Italy, because on the one hand it includes losses and on the other it omits the output of industrial plants, which latter appear to be included in the Italian statistics.

The table gives classified energy consumption during 1932 as recently announced by the National Fascist Union of Electrical Industries. The population is about one-third and the energy consumption one-eighth as great as in the United States:

Class of Service	Thous. Kw.-hr.	Class of Service	Thous. Kw.-hr.
Domestic lighting	667,721	Electrochemical and electrometallurgical industries	2,352,771
Public lighting	224,564	Agriculture	103,109
Appliances	186,924	Municipal and public service	168,759
Manufacturing	3,592,875	Traction	872,255
Mining and quarrying	79,904		
Industrial heat	198,231	Total	8,447,113

Practical Intake Designs for Small Hydro Plants

Pioneering Water-Power Installations Require Departures From Standard Practices. Intake Designs Important



A small automatic hydro plant

By R. JOHNSON
Consulting Engineer, Cheyenne, Wyo.

DURING the past few years the writer has installed eleven hydro-electric systems, complete from the dam to the tailrace. These plants are small in size, averaging 10 to 30 kw. each, but their fundamental design is exactly that of a super-power development. With the installation and constant inspection of these small hydro-electric units there have been unusual opportunities for developing and testing designs for dams, intakes, canals, forebays, penstocks, turbines, power houses, tailraces, etc. Basic problems confronted have been those due to floods, trash and sand and gravel in the summer and ice and freezing weather during the winter.

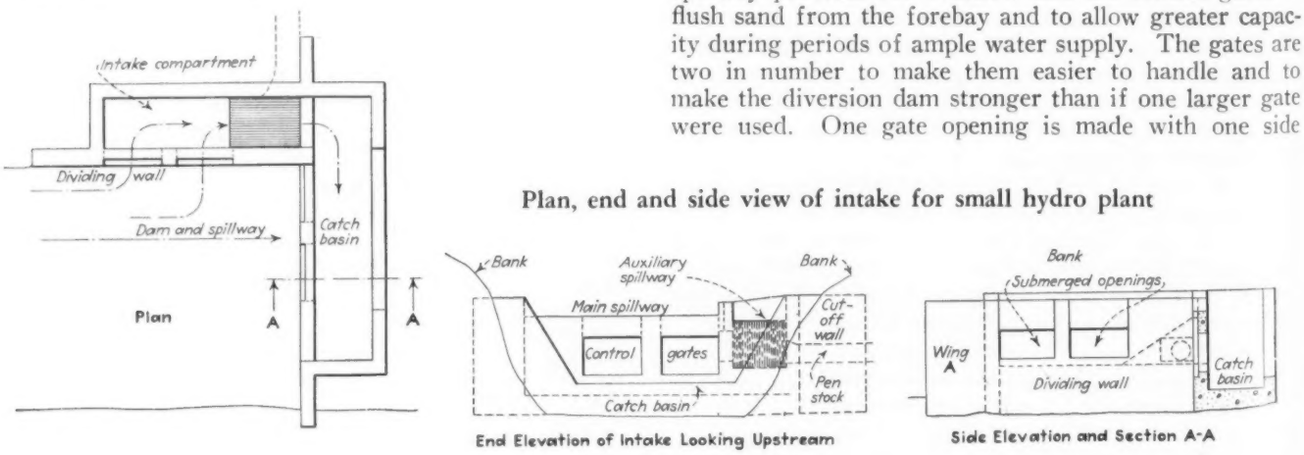
More or less standard designs have now been adopted to deal with these conditions. It is expected that these designs will be changed and improved from time to time, although at present they are satisfactory. This article gives a description of a newly developed form of intake as being typical of such work and of importance because of its wide variation from standard practice.

The plants, as previously mentioned, are entirely automatic and are operated, in general, by owners of large ranches and estates, by isolated communities and persons living in places where power lines are absent and who must generate their own power, if they are to have any. Their only knowledge and interest in their system is in "pressing the button," and as a result their equipment tends to be neglected and the entire design and operation must be entirely reliable and simple. Usually no more attention is paid to his power property by the owner or his employees than the average household user in a city pays to his electrical supply.

The accompanying illustrations show a plant having an output of 15 kw. at 230 volts and a head of 53 ft. Water is taken from the river by a canal serving the dual purpose of supplying water for power and irrigation during the summer months, but with only enough water available during the winter months to operate the hydro-electric plant. Because of these features the plant is comparable to a run-of-river unit, the canal serving the same functions as the river itself, only on a smaller scale.

The intake consists chiefly of a diversion dam with control gates and spillway and a separate compartment containing the trash rack and a small auxiliary spillway for the water to the power plant. Relative dimensions are for this one particular case and are to be varied for local requirements.

The purpose of the diversion dam is to back up the water in the canal to form a forebay of still water; the spillway provides for overflow and the control gates to flush sand from the forebay and to allow greater capacity during periods of ample water supply. The gates are two in number to make them easier to handle and to make the diversion dam stronger than if one larger gate were used. One gate opening is made with one side



Plan, end and side view of intake for small hydro plant

flush with the wall, forming the separate compartment, so no projections or water eddies will interfere with trash floating down stream or sand and silt along the bottom.

This wall separating the intake compartment from the forebay has two submerged openings of ample size. These openings are submerged to prevent floating trash and ice entering the intake compartment. The lower edge of the openings is 9 in. higher than the bottom of the control gates in the diversion dam to minimize sand and non-floating trash entering the intake compartment. The upstream section of the dividing wall is a straight-line extension of the wall itself to prevent eddy currents. Openings are of more than ample size for this same purpose, so the water entering will not make a sudden bend and will not be swift enough to draw through much trash.

In the intake compartment itself the trash rack is inclined so trash will tend to be pushed along to the top part of the rack, where an auxiliary spillway allows surplus water to carry it on over and back into the canal below the diversion dam. This auxiliary spillway is 4 in. lower than the main one in order to insure a certain flow of water over the trash rack at all times, unless the available flow is so slight that all of it is required by the turbine.

A 3-in. pipe also extends from the bottom of the intake compartment, below the trash rack, through the wall of the diversion dam and into the catch basin to carry away sand and silt that might be carried by the water entering the compartment. During a period of low water the flow is always clear and the pipe is then kept closed to prevent water that might be needed for the turbine and auxiliary spillway from flowing through the pipe and on down stream. The floor of the intake compartment is lower than the entrance to the penstock, so silt will tend to flow through the 3-in. pipe and not into the penstock and on into the turbine.

It is widely agreed that the chief trouble during winter months for a hydro-electric plant is due to the formation of frazil ice. In such a form it clings readily to trash racks, turbine gates and runners, causing much grief and trouble.

During freezing weather frazil ice does not enter the intake compartment to an appreciable extent, because its entrances are below the water level and the water velocity is too low to carry such ice down and through the openings. However, frazil ice does start forming on the dividing wall above the openings and a sheet of ice begins to grow across the canal and in an up-stream direction. This ice acts as a further barrier to frazil ice entering the compartment, since it offers a surface continually growing up stream on which the frazil ice in the water may form. After a prolonged cold spell the streams are almost completely frozen over and then frazil ice is a thing of the past and the future, but not of the present.

Intake designed to prevent interference from trash, ice and sand

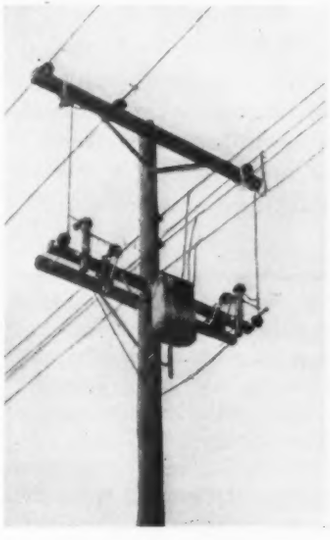
The water in the intake compartment does not even freeze over until some time after the canal has done so. This is because of the lack of any quality of frazil ice flowing into the intake compartment. Thus there is practically none to enter the trash rack or the turbine gates and runner. Likewise, the tailrace is very backward about freezing over, due to this absence, even though the water is quiet and almost still. Winter temperatures of 30 deg. below zero are common and 50 below happens at least every two years.

During a period of thaw there is no trouble from floating ice because it cannot readily enter the submerged openings in the intake compartment, but is carried on down stream over the main spillway. If, by chance, any ice should enter the intake compartment it would be carried on over the trash rack and the auxiliary spillway.

Floods, trash, sand and gravel in summer, ice and freezing weather in winter, are the big problems in small isolated hydro installations. Reliability is important and service must be maintained. On the basis of several years' experience with this familiar Western problem, Mr. Johnson indicates just how other small hydro operators may overcome the difficulties most effectively.

Live Line Tap Used on Primary for 6.6-Kv. Transformer Installation

By F. W. LACHICOTTE
Electrical Engineer Southern Public Utilities Company, Charlotte, N. C.



Transformer installation on 6.6 kv. can well be made by employing the principle of the live line tap as evolved for the higher voltage lines. In our construction, as shown in the accompanying illustration, the Kearney 1812 G live tap is used and the rest of the installation is executed by using a Line Material open type fuse and a valve type of arrester. We believe the assembly is trim, inexpensive and adapted to safe installation and maintenance.

Network or Radial

One of the Most Important Engineering-Economic Decisions Which Confront Power Company Engineers and Their Executives

By D. K. BLAKE
Engineer Distribution Systems
General Electric Company

Many properties are studying the over-all advantages and disadvantages of the primary network system as compared with the familiar radial system. Mr. Blake, on the basis of experience and background, is well qualified to make this evaluation. He points to an analysis which may well be applied by the engineers of any property. A new and practical approach to an important problem.

FUTURE expansions of the distribution system when using an intermediate voltage such as 4,000 or 4,600 will consist of small standardized substation units connected as a radial system or else connected as a primary network system. Consequently we are able to make a comparative study between radial and network systems using the same substation units and thereby eliminate differences in substation costs due to different substation arrangements and capacities. Inasmuch as the Buffalo system* has already proved itself in competition with other radial systems and the primary network because of local conditions, we shall use their rating of 2,500-kva. units in this comparison to show what factors are favorable to the grid arrangements. Furthermore, the type of station used in Buffalo can be duplicated by any company at about the same cost, so it is unnecessary to bring in the advantage of factory-assembled units as a part of the comparison.

It should be clearly understood that this comparison assumes uniform ideal conditions and, therefore, is illustrative only and proves nothing where the circumstances and costs are different than those assumed here. Any one having sufficient interest can substitute his own cost figures where he thinks those used here are too high or too low. Unit cost assumed for six-duct conduit is $5.10, four-duct at $3.60 and two-duct at $2 per trench foot; $1 per foot installed was assumed for No. 4/0, three-conductor, 4-kv. cable and $2.25 per foot for 350,000-circ.mil, 23-kv. cable.

An area supplied by a radial system consisting of four three-unit substations is shown in Fig. 1. Each substation is composed of three standardized units, each unit consisting of a transformer, regulating equipment and five circuit breakers, and they are connected together in such a manner as to give nine radial circuits, which are distributed as shown. The voltage regulation with this system is calculated to be 3.91 per cent at the end of the primary branch at the greatest distance from the substation. This value assumes underground No. 4/0 three-conductor feeders from the substation to the first load in the area to be served by that feeder. This regulation occurs at the load density of 700 kva. per square mile, with a feeder length of 1½ miles for the cable portion and ½ mile of No. 1 conductor for the overhead portion to the load center. Each radial branch from the load center would be No. 1 conductor ½ mile in length. The over-all area would be 3 miles wide by 12 miles long. The dotted lines are the overhead mains, of No. 1 copper or larger, ordinarily used in the radial system to distribute the load in various directions from the main feeder cable.

The network layout is illustrated with the same twelve units located at twelve places instead of four. Voltage regulation to the most remote point is 3 per cent. However, under emergency conditions, the voltage regulation will be about 8 per cent in the network. It is evident from the illustration that the dotted lines for the network are equivalent to the dotted lines or No. 1 conductor in the radial system, but that the network has eliminated the need of the nine 4-kv. cables that feed from the substation in their respective feeder areas. The feeders of the radial system are assumed to be underground for the reason that overhead construction would increase the total regulation for the lighter densities to a value difficult to correct by bus regulation. Furthermore, it is quite common practice to use underground construction to eliminate pole congestion. As the load densities increase, the regulation will permit overhead construction, but it is quite a common experience that the higher densities require underground construction for other reasons. It is, therefore, evident that we have the same territory with the same load supplied by a network grid having the same number of unit substations, giving a voltage regulation slightly better than the radial connection for normal conditions, but somewhat inferior under emergency conditions.

The load interrupted on some of the network ties is twice that in the radial system. This is inherent in the network as long as the comparison is based on the same identical units.

The transmission layout is shown in Fig. 2, using 350,000-circ.mil cable throughout in both schemes at a cost of $2.25 per foot installed. In either case three transmission feeders are used with the network, requir-

*ELECTRICAL WORLD, *July 25, 1931. "Electrical Engineering," December, 1933.*

Distribution?

ing about 27 per cent more cable investment due to the lateral high-voltage feeders to take the place of the 4,000-volt cables omitted in Fig. 1.

Feeders saved must balance cables added

Now, the whole question of the network connection versus the radial connection of the same units hinges upon the relative cost of the 4-kv. feeders saved and the high-voltage transmission cables added to the network. It is obvious that the comparison will show a different result if circumstances are such that overhead 4-kv. feeders and overhead or aerial cable transmission laterals are used. These variations any one can work out for himself. The only purpose here is to make clear the influence of these two factors. It is clear, therefore, that any application of the primary network system that does not permit a saving in 4-kv. feeders could hardly have a lower investment for the simple reason that the transmission cost is usually greater.

A comparison between the conduit system of the radial and network methods is shown in Fig. 3. It is clear that where it is necessary to use a substantial amount of underground construction for 4-kv. feeders the primary network requires less underground construction, both from the point of view of the trench feet (about 83.5 per cent) and duct feet (about 67.5 per cent). In the radial system the horizontal conduit out of the substation requires three ducts for high-tension cable and three ducts for 4-kv. feeders. We have considered only four ducts where there are nothing but transmission cables. This is because we have assumed four ducts for three transmission cables with the network. The vertical conduits on the radial system all have two ducts filled with 4-kv. cable. The vertical conduit with the network system is also two-duct, but has only one high-tension cable.

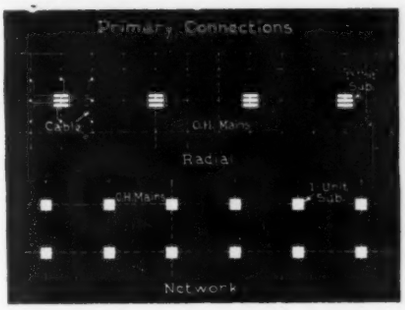
The tabulation in Tables I and IA shows the cost of conduit, high-voltage cable and low-voltage cable for the

Table I—Conduit and cable investment

Load Density Kva. Sq.Mi.	Radial System Fig. 2 Conduit	Radial System Fig. 1 4-Kv. Cable	Radial System Fig. 3 23-Kv. Cable
700	$412,000	190,000	374,000
1,565	274,000	126,500	250,000
2,780	205,000	95,000	208,000
4,350	164,000	76,000	149,500
6,250	137,000	63,400	125,000
	Network System		
700	287,500	.....	475,000
1,565	191,700	.....	317,000
2,780	144,000	.....	264,000
4,350	115,200	.....	190,000
6,250	98,200	.....	158,500

Table IA—Total street investment (Fig. 2)

Load Density Kva. Sq.Mi.	Radial	Network	Savings
700	$976,000	$762,500	$213,500
1,565	650,500	508,700	141,800
2,780	508,000	408,000	100,000
4,350	389,500	305,200	84,300
6,250	325,400	256,700	68,700



The same load area is supplied by the same number and design of standardized unit substations. In the radial system three units are grouped at one location with nine radial feeders supplying one-fourth of the load area. Each feeder has its own overhead branches (shown by the broken lines), which are not interconnected with the other feeders. In the other case each unit is at a separate location without the use of feeders, but interconnected by means of the dashed lines which correspond to the overhead branches in the radial system.

Fig. 1—Comparative service to the same load area

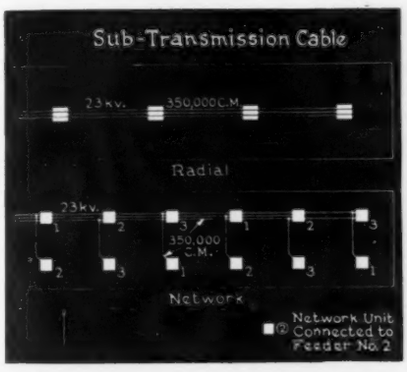


Fig. 2 — Three subtransmission cables, each one supplying four of the equivalent unit substations

With the network arrangement it is necessary to have a number of laterals tapped to the main group in order to supply the other half of the units.

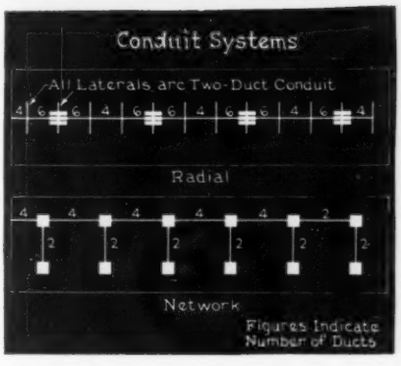


Fig. 3—Relative layout of underground conduit for two different methods

Obviously there are more conduits and ducts for the radial system than for the network. If underground construction is required for the network subtransmission laterals and not required for the low-voltage radial feeders, then the situation is reversed. Much depends on this factor.

radial system, compared with conduit and cable for the network system. It is observed that the network requires less investment in these elements. Regardless of the density, the saving in favor of the network is about 21 per cent, considering only these elements. The percentage, of course, would be much less when the substation costs are added. As the density increases the total dollars saved on cable and conduit decreases. All of the densities illustrated here are assumed as initial conditions, so it is probable that in the higher densities secondary network systems, either of the overhead or underground type, would prove more economical for a new installation.

Now we have to consider the question of substation cost where we have assumed that the two are identical because of the same units being used. There are two factors, however, which have to be taken into consideration that are inherent in the network requiring additional expenditure of money that is not required in the radial system. In the first place, it is certainly true that the load in a network will not divide as perfectly as in the

radial system, particularly under emergency conditions with one transmission feeder out of service.

The load on the units with No. 3 feeder out of service is shown in Fig. 4. Inasmuch as each unit is rated 2,500 kva. and is capable of carrying 25 per cent overload under emergency conditions, the radial system is good for a firm capacity of 25,000 kva. This same load supplied with the network arrangement using the same number of units would give a load of 2,080 kva. on each network unit under normal conditions. With transmission feeder No. 3 out of service the worst condition would be to have the adjacent units pick up all of the load, so that the load distribution illustrated is obtained. It is seen that units No. 1 and No. 2 on the right-hand side of the network will have the greatest load, which is about 3,820 kva. This means, therefore, that either an additional risk has to be taken by allowing a 50 per cent overload or else additional money will have to be put into the network system.

Now, there are two ways that this additional money can be put into the network system. First, more network units can be added, but this will require an investment in switchgear and additional underground and transmission cable circuits that are not required from the overload point of view. The transmission cables divide the load within reasonable limits, 12,150 kva. for No. 1 and 12,850 kva. for No. 2, so no additional money is needed here. The neck of the bottle is the transformer itself. It seems, therefore, that inasmuch as transformer emergency capacity can be obtained at a reasonable cost, that would be the thing to do. Therefore, each network transformer will have to be increased in its normal rating from 2,500 kva. up to 3,050 kva. so as to have an overload capacity of 3,820 kva., which is 25 per cent. This capacity is figured at $2 per kva. (assuming tap-changing equipment), which gives an increase of $13,200 in order to keep the transformer capacity from being the neck of the bottle. So even if a load division no better than this could be obtained, the problem is easily solved by simply allowing for more transformer capacity.

Effect of real estate cost and shape of area served

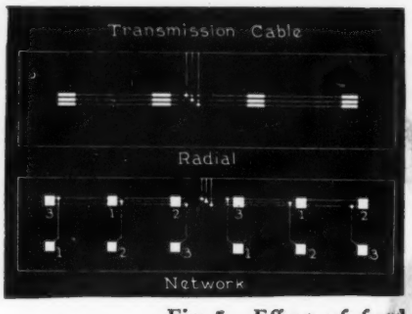
ANOTHER factor will have to be considered in substation cost, and that is we now have to have twelve pieces of real estate instead of four. If we assume we can obtain eight lots at $5,000 per lot, this requires an additional investment of $40,000. Adding the two together for the same standardized substation unit, the substation cost for the network will be $53,200 greater than for the radial system at any of the densities, so that our total savings for the network over the radial method is not very much at the highest densities, but is a substantial amount at the lower densities. It must be appreciated that the industry is chiefly interested in these lower densities when considering the application of the 4-kv. systems.

An alternative arrangement of the same area but having the generating station located at a different point, so that the cables now enter the area at the middle of the long side instead of the narrow side, is shown in Fig. 5. This circumstance is more favorable to the network system so that now a saving of about 26 per cent instead of 21 per cent is obtained in cable and conduit construction, as shown in Table II.

Still another arrangement of the two schemes is shown in Fig. 6, but this time the rectangular area is square

When a subtransmission cable is out of service, say No. 3, for any cause then the load division on the remaining units is 3,125 kva. for each unit with the radial system, but is as illustrated with the network system. Much depends on how this fact is evaluated in the comparison.

Fig. 4—Effect of outages on load division



The point at which the subtransmission cable has to enter the load area under consideration has a noticeable effect on the relative cable and conduit costs. To enter at the side instead of the end of the area may increase the feeder conduit for the radial system and decrease the subtransmission cable for the network, as illustrated in this case.

Fig 5—Effect of feed location

and, therefore, obviously more favorable to the network than the other arrangement. In this case the saving in conduit and cable cost for the network is substantially greater, being about 39 per cent in favor of the network, as shown in Table III. In addition, the load division is improved, so that we only need to spend $7,600 for additional transformer capacity instead of $13,000. Observation of numerous systems shows a high percentage of practical cases approximating this ideal arrangement.

Now let's take a look at Fig. 7, where the circumstances are assumed to be such as to produce a very decided advantage in favor of the network arrangement. This time the area is supposed to be just two of the adjacent areas assumed in Fig. 1. It is obvious that with the radial system we would have just twice the number of substations with conduit and cable construction. That is, there would be three cables and four sub-

Table II—Total street investment (Fig. 5)

Load Density Kva. Sq.Mi.	Radial	Network	Savings
700	$987,100	$725,150	$261,950
1,565	657,400	483,830	173,570
2,780	513,550	389,320	124,230
4,350	393,930	290,300	103,630
6,250	329,100	244,215	84,885

Table III—Total street investment (Fig. 6)

Load Density Kva. Sq.Mi.	Radial	Network	Savings
700	$1,036,000	$599,600	$436,400
1,565	692,000	420,000	272,000
2,780	518,500	315,000	203,500
4,350	415,000	252,000	163,000
6,250	346,000	210,200	134,800

Table IV—Total street investment (Fig. 7)

Load Density Kva. Sq.Mi.	Radial	Network	Savings
700	$1,952,000	$1,497,000	$455,000
1,565	1,301,000	997,000	304,000
2,780	1,016,000	747,000	269,000
4,350	779,000	597,000	182,000
6,250	650,800	498,000	152,800

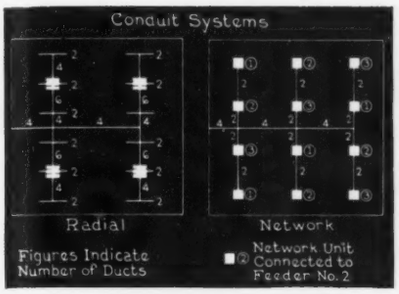
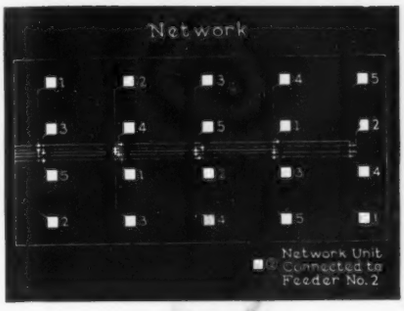


Fig. 6—Effect of shape of load area

The square area illustrated gives an increase for the street work in the radial system and a pronounced reduction for the network system as compared to a long narrow area.



The area illustrated here is equivalent to two areas like Fig. 2 placed side by side. The radial system would have just double the number of substations, conduits and cables. The network would have only five subtransmission cables instead of six, and twenty substation units instead of 24 if two areas like Fig. 2 are placed side by side. The network conduit and subtransmission is also less than twice that required for a single area. Note that the subtransmission feeders are so interlaced as to give almost equal division of load on remaining units in event of one feeder being removed from service.

Fig. 7—Effect of a doubled area

stations for the upper half and three cables and four substations for the lower half. With the network arrangement, however, we will need only five cables and twenty of the standardized units instead of 24 units with radial connection. Table IV gives the conduit and cable cost for the two schemes, showing that the network has a saving of about 23½ per cent. In addition to this, we have a decided saving of about $140,000 in substation cost by omitting four units. If we assume it is 5 miles to the generating station from the edge of the area, we save $62,500 for that one cable and about $25,000 for its switch position. With this network arrangement load division is much better than the others and requires only $8,000 additional investment for all of the twenty units. We do have to have twelve extra pieces of real estate, costing $60,000, so that the total substation and subtransmission savings become about $160,000, which is to be added to the savings of $152,800 for cable and conduit within the area, giving a total of $312,800.

From this analysis we see that there are two requirements in order for the network system to have a substantial economy over the equivalent radial system. First, the circumstances must be such that the network will actually save 4 kv. cable and underground construction. Second, that for large areas permitting a common network over the entire area, or, what is the same thing, a smaller area of higher density permitting a large number of units interconnected into a common network, the network will not only save money on cable and conduit but will also save money on substations and even transmission cable if the distance between the area and the generating station is substantial. Any attempt to apply a network to circumstances other than these is very apt to show a greater cost for the network. The savings shown in the analysis cannot be applied to any existing system unless it can be shown that the local circumstances correspond with the ones assumed in this analysis.

Operations Show Turn from Year-End Conditions

Definite improvement in the operations of electric light and power companies is evident when data for the latest available twelve-month period are compared with those for the calendar years 1933 and 1932. The former relate to the period ended April 30, 1934. They show that revenue from ultimate consumers surpassed that of the preceding like period by 1 per cent, with a total of $1,794,903,400. The amount of energy generated was larger by 9.9 per cent and sales rose 11.5 per cent. These figures contrast favorably with those prevailing only four months earlier. The downward trend of income has been reversed and the gain in output increased.

Revenues for all of the major classes of service of electric light and power companies were smaller in 1933 than in 1932, although in one group, wholesale light and power, the quantity of energy used was 8.1 per cent larger. Statistics for the two years, as announced by the Edison Electric Institute, are reproduced in the accompanying tables.

While total energy sales increased 3.1 per cent, the

Sources and Disposal of Energy

	—Thousands of Kw.-Hr.— 1933	1932	Change Per Cent
Generated from fuel	47,426,520	45,778,383	+ 3.6
Generated from water power	31,591,146	31,106,865	+ 1.6
Total generated	79,017,666	76,885,248	+ 2.8
Purchased from other sources	2,288,406	2,178,581	+ 5.0
Net international imports	605,852	440,884	+37.4
Total additions to supply	2,894,258	2,619,465	+10.5
Used in electric railway depts.	698,815	842,976	—17.1
Used in electric and other depts.	1,203,608	1,219,625	—1.3
Total deductions	1,902,423	2,062,601	— 7.8
Energy for distribution	80,009,501	77,442,112	+ 3.3
Lost in transmission, distribution, etc.	14,255,893	13,678,088	+ 4.2
Sold to ultimate consumers	63,753,608	63,764,024	+ 3.1

Energy Sales and Revenue, by Consumer Classes

Class of Consumer	—Thousands of Kw.-Hr.— 1933	1932	Change Per Cent	—Revenue, Dollars— 1933	1932	Change Per Cent
Domestic service	11,960,256	11,986,872	— 0.2	656,570,100	669,199,700	— 1.9
Commercial—small lt. and pwr. (Retail)	12,474,822	12,932,095	— 3.5	499,684,400	528,861,300	— 5.5
Commercial—large lt. and pwr. (Wholesale)	33,722,373	31,185,783	+ 8.1	465,190,800	476,450,600	— 2.4
Municipal street lighting	2,213,007	2,364,480	— 6.4	94,269,500	100,918,700	— 6.6
Street and interurban railways	4,003,876	4,175,022	— 4.1	36,358,900	38,310,700	— 5.1
Electrified steam railroads	661,387	539,901	+22.5	6,549,900	5,821,000	+12.5
Municipal and miscellaneous	717,887	579,871	+23.8	14,792,000	13,033,900	+13.5
Total, ultimate consumers	65,753,608	63,764,024	+ 3.1	1,773,415,600	1,832,595,900	— 3.2

Note: Data for 1932 and 1933 are subject to revision pending final 1932 U. S. Census releases.

corresponding revenue from ultimate consumers fell off 3.2 per cent. Domestic sales were virtually equal in both years, but revenue was 1.9 per cent smaller in 1933 than in 1932. Both revenue and energy decreased in the case of retail light and power sales, the former more than the latter.

The E.E.I. figures differ slightly from those published in the ELECTRICAL WORLD of January 6, 1934, which were necessarily partly estimated for 1933 and which are now superseded. They are in turn subject to revision when final U. S. Census statistics are released for 1932. Preliminary releases show total revenue of $1,821,105,-524 from ultimate consumers, thus closely corroborating the E.E.I. figure, though shifts may be necessary between some of the component items.

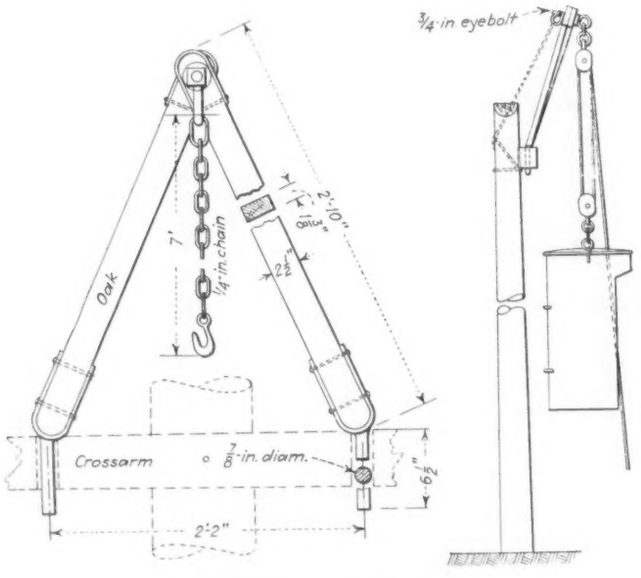
Transformer Pole Mounting Speeded by Handy Gin

By ROY E. WENK

Engineer Puget Sound Power & Light Company, Everett, Wash.

Transformers up to and including 15 kw. size can be quickly and easily hung on the top crossarm with this handy gin. It is quickly mounted directly on that member by inserting the projecting steel pins in the adjacent pin holes on each side of the pole. These holes are seldom used for wire positions, so the scheme has proved very satisfactory. The gins are carried on all line trucks and were made complete in the company's shops. Small transformers are easily raised by hand and larger sizes are raised by carrying the hoisting line to the drum of the power winch on the line truck.

The legs of the gin are of oak and the fittings are forgings. The seven feet of $\frac{1}{4}$-in. chain attached to the clevis at the hinge is wrapped around the pole for a guy and quickly made fast by the hook. A set of double blocks is suspended from the eye provided for this purpose to raise the transformers.

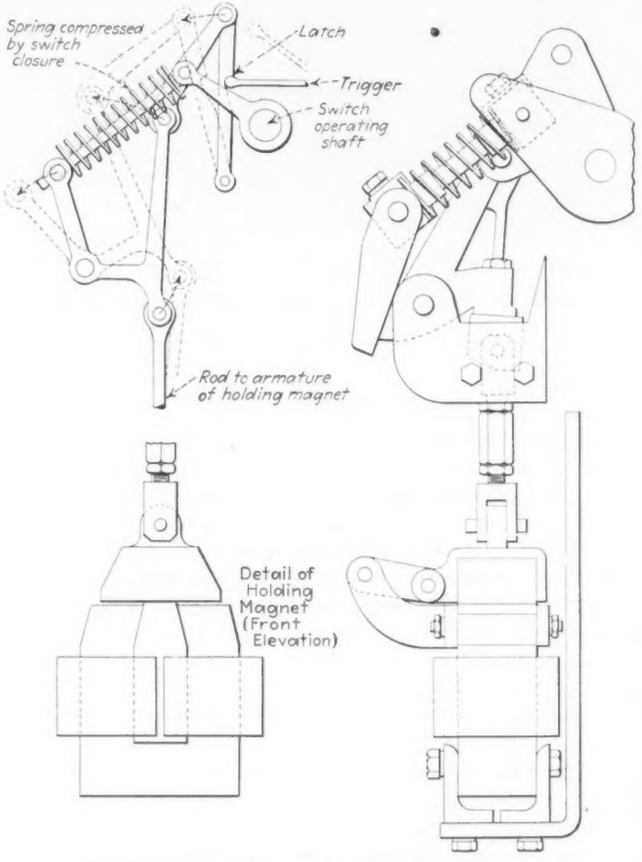


Easily mounted gin handles transformers up to 15 kw.

POWER COMPANY

Faster Tripping Speeds

In most cases trigger latches of circuit breakers are tripped by the closing motion of an electromagnet which is energized by relay operation. The opposite method, trigger tripping by a spring which is released by the demagnetization of a holding coil, has been, and is being,



Holding-coil device for breaker tripping

The front and side views show the design of the mechanism as applied to Deion air circuit breaker. Principle of operation appears in the skeleton diagram. With holding magnet energized tripping spring is compressed by closure of breaker, resulting in condition shown by solid lines in diagram. With de-energization of holding magnet tripping spring throws lever assembly into position of dotted lines, releasing breaker trigger.

used to some extent, but more on lighter devices than on circuit breakers. Also, the use of holding magnets in high-speed operations has not been much considered in the past because of the persistence of magnetization after the magnet circuit is opened. In a search for means to speed up operation of certain circuit breakers, J. J. Samson and C. H. Koehler, Commonwealth Edison Company, Chicago, wondered if greater speed could not be attained by the latter method in spite of its classic disrepute in such applications. So they designed and experimented and arrived finally at the tripping mechanism illustrated in the accompanying drawing. They applied the device

ENGINEERING PRACTICE

to 12-kv. Deion air circuit breakers on the Commonwealth Edison system, operating it in conjunction with a high-speed relay, and found that it did, actually, result in an over-all clearing time of from 3¾ to 4½ cycles, depending on the point on the wave at which the fault occurred.

The success of the method as worked out by Messrs. Samson and Koehler lies in several features that distinguish their design. Included among them are the use of a very high grade of silicon steel sheet in the core of the holding magnet to assure extraordinarily rapid flux decay when the exciting circuit is opened and a highly saturated magnetic circuit to compensate for any dirt that might get in between the armature and magnet core. As designed, the pull on the armature is in the neighborhood of 200 lb. even with several thicknesses of paper in the gap. By its nature, the tripping circuit is continuously self-supervisory since the breaker will open on any failure of control energy.

Manhole Casting Grinder Saves Many Renewals

By WILLIAM BEAUREGARD
Superintendent Underground Department,
Fall River (Mass.) Electric Light Company

For grinding new cover seats on worn manhole castings a special machine has been developed by the author which has saved its cost many times over when figured against the expense of replacing castings. This tool also makes it unnecessary to disturb the existing pavement or road surface, a feature which should be appreciated by any one who has sought permission from municipal authorities to disturb a busy thoroughfare or a particularly good road surface. A substantial saving is also made by the elimination of expensive street repairs.

The machine, although rugged, may be easily transported in the field and is simple in operation. An average cable splicer and helper can do a first-class job with but little experience. The machine fits into the manhole opening and is supported and revolved on ball casters, bearing on the rim of the casting. Adjustable fingers center the base plate accurately and fine control of the grinding unit permits the operator to work with precision in two directions, both as to depth of cut and diameter. The grinder now in use is driven by a 1-hp., 110-volt, single-phase, dust-proof motor equipped with special bearings to operate in a vertical position. A cord dropped through the plate into the manhole is connected to secondaries, or where no cable source is available arrangements are made to plug into a nearby customer's outlet. The 5x1-in. cutting wheel mounted on the rotor shaft is 5x1-in. silicon carbide and runs at 3,500 r.p.m.

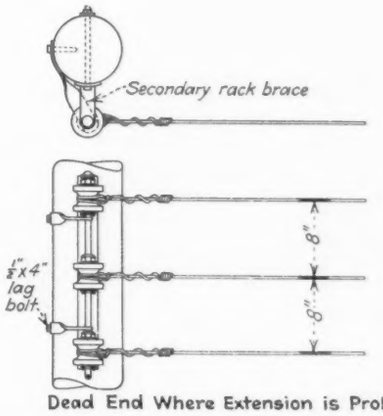
Portable manhole casting grinder forestalls many replacements

Once set up, the plate carrying the grinder is revolved by hand, whether it be to remove high spots along the seat or to make a cut around the entire circumference. In a badly worn casting a deep cut is taken, a flat 1x1¼-in. steel ring being inserted and fastened in place with flat head machine screws to restore the seat to its original height. The advantage of this ring is that when it becomes worn replacement can be made without additional grinding.

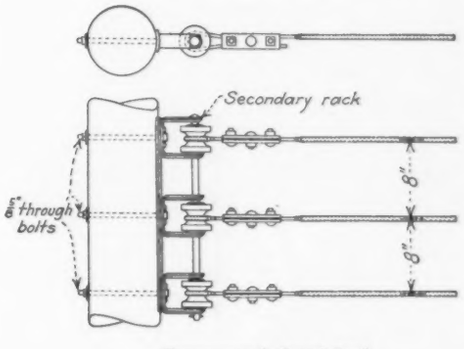
In actual operation, two men can set the machine, grind a casting and fit and fasten a new ring seat in five hours.

Dead Ending That Allows for Future Extensions

The end of a secondary circuit may not be the end forever, it may have to be extended in the future. In such cases, where extensions are expected, the dead end should be so constructed that an extension can be made without either removing the circuit or adding messy parts. This can be done by dead ending to the side of the pole as is shown in the accompanying illustration of the West Penn Power Company. A permanent type of dead end is also shown.



Dead End Where Extension is Probable



Permanent Dead End

May Industry Holds Spring Level

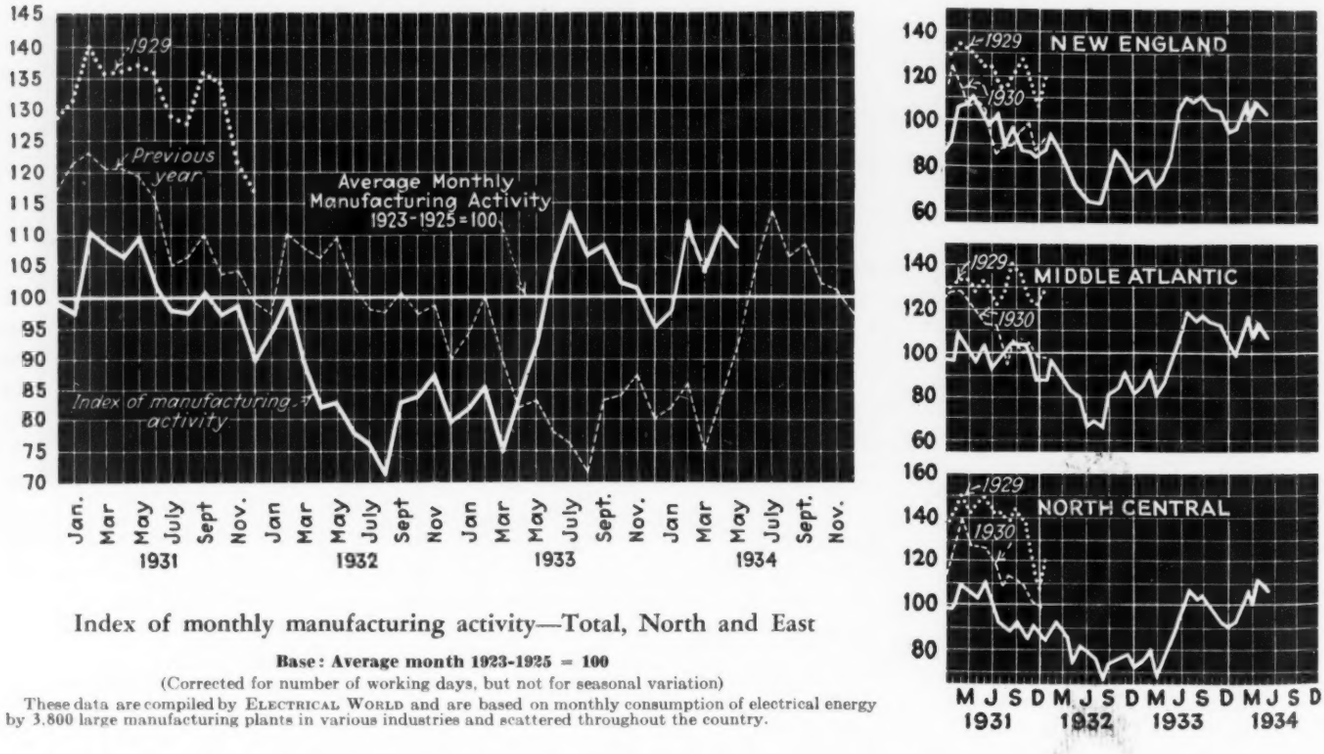
Electrical World's monthly survey of energy consumption by industries shows May average close to April, with 17 per cent lead over last year. For the third time this year the figure surpasses any in 1933 except July. The unbroken advance in iron and steel continues. Stone group at year's high. Automobiles and textiles recede.

ENERGY consumption in the group of industrial plants surveyed each month by ELECTRICAL WORLD indicates a continuation in the rate of industrial activity registered during the past few months. Total operations in May were fully equal to those of April, but when adjustment is made for the difference in the number of work-days May shows a recession of 2.5 per cent. The average of the first four months in 1934 was surpassed by 2 per cent.

A year ago the upward movement was in full swing, but the present figure is nearly 17 per cent higher than that of the corresponding month of 1933, 32 per cent over 1932 and virtually on a level with 1931. Fully half of the ground lost since 1929 has been regained; the deficiency compared with May of that year amounts to 21 per cent.

Changes in the individual industry groups differed. In automobiles the rapid ascent of recent months was checked, with a decrease of 11 per cent from April. Indicative of the improved conditions, however, is the gain of 50 per cent over last year's May. Textiles receded 8 per cent, leaving a small margin over last year, and leather products slipped 11 per cent.

In contrast there has been noteworthy strength in two important durable goods industries. Iron and steel has been gaining steadily from the secondary recession of last November and has reached the best figure since the spring of 1931. The stone group, improving on earlier spring gains, is 48 per cent above last winter's minimum. Other changes from April were generally small.


1929
Previous year
Average Monthly Manufacturing Activity 1923-1925=100
Index of manufacturing activity
NEW ENGLAND
MIDDLE ATLANTIC
NORTH CENTRAL
1930
Jan. Mar May July Sept Nov Jan Mar May July Sept Nov Jan Mar May July Sept. Nov. Jan Mar May July Sept. Nov.
1931 1932 1933 1934
M J S D M J S D M J S D M J S D
1931 1932 1933 1934

Index of monthly manufacturing activity—Total, North and East

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
Industrial Groups	May, 1934	Apr., 1934	Mar., 1934	May, 1933	May, 1934	Apr., 1934	Mar., 1934	May, 1933	May, 1934	Apr., 1934	Mar., 1934	May, 1933	May, 1934	Apr., 1934	Mar., 1934	May, 1933
All Industry	**108.2**	**111.0***	**104.0**	**92.8**	**104.2**	**108.7***	**101.1**	**85.7**	**107.3**	**112.0***	**108.9**	**97.3**	**108.4**	**111.0**	**103.8***	**89.1**
Automobile (incl. parts and accesories)	90.2	101.0*	92.3*	58.9	.....	.....	.....	.....	77.8	90.7	85.5	55.7	90.8	102.1*	92.7*	59.1
Chemical products (incl. oil refining)	154.5	160.5*	149.7	127.1	179.5	186.4	142.0	135.1	171.8	176.5	162.3	131.0	127.1	131.0	120.0	129.3
Food products	120.7	116.0*	107.0	126.2	.....	.....	.....	.....	117.4	121.0	111.7	129.5	121.2	111.7*	101.6	123.2
Iron and steel	97.2	96.0*	90.5	68.8	139.7	135.2*	121.6	108.8	83.3	81.7*	81.9	57.0	102.0	102.2	93.8	74.7
Metal working	88.5	90.1	85.0	63.7	112.5	118.0*	110.0	82.0	75.2	75.5*	70.5	57.2	100.0	101.5*	97.1	64.8
Metals group	91.7	92.3*	87.1	65.5	120.3	123.2	113.2	89.5	78.8	78.2*	75.5	57.1	100.7	101.8*	95.8	68.5
Leather products	93.2	104.0*	99.0	93.5	77.4	96.8*	89.8	78.2	107.0	112.7*	111.3	119.4	94.7	99.8	92.6	81.5
Forest products	104.3	108.7*	102.3	91.3	47.7	46.1*	47.2	41.0	60.4	62.3*	62.7	52.0	90.5	89.7*	85.8	84.0
Paper and pulp	127.0	126.8	122.5*	112.0	133.0	129.3*	116.0	112.5	102.5	107.2*	103.3	89.2	115.8	114.8*	110.7*	104.4
Rubber products	143.0	143.0	138.2	124.5	118.1	111.0*	116.1	112.9	.....	.....	.....	.....	152.2	151.2	146.3	126.3
Shipbuilding	79.5	80.2*	85.7	71.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	107.0	103.5*	86.4	90.0	.....	.....	.....	.....	94.2	82.8*	59.4	72.8	111.0	128.6*	109.3	105.7
Textiles	101.5	109.6	106.4	96.4	77.7	84.1	84.5	69.0	122.4	135.5*	143.0	132.2	128.7	145.0*	149.5*	118.4

*Revision.

In the various geographical divisions national movements were in general paralleled. For example, textiles sagged everywhere; iron and steel quite uniformly gained, or at least held fast.

Operations in East decrease slightly

In New England a 4 per cent decrease in the average from April reflects primarily the contrary movements of the metal and textile industries. The latter slid 8 per cent from the level of the preceding two months, but remains 12 per cent over May, 1933. Iron and steel has been advancing, the rise since January being 21 per cent, whereas metal-working industries slackened somewhat from April, but surpassed March.

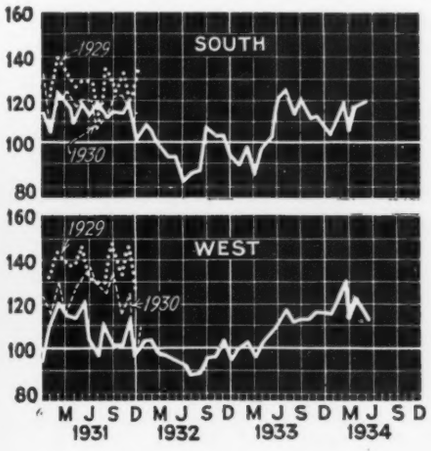
In the Middle Atlantic states the most pronounced changes were in textiles, 10 per cent under April, and automobiles—of secondary importance in this region—down 14 per cent. Other industries contributed, though not importantly, to lower the average 4 per cent, again excepting iron, which advanced. Stone rose 13 per cent over April and 29 per cent over last year.

Cross-currents of lessened activity in the Central area in automobiles, textiles and the stone group, with increased operations in foods and stability in other industries resulted in a May average for that region 2.5 per cent under April, but 21 per cent over May, 1933.

South gains, West loses

Strongly responsive to two important industries, textiles and steel, the South was the only region to advance beyond the April rate of operations. Unlike others, its decrease in textiles was small, its increase in iron and steel large. The fact that the latter industry has during the past year almost doubled is worth noting. The South also reports an advance, over April, of 14 per cent in food products.

Until March the West had been progressing from the valley of 1932 more steadily than any other region. More recent movements have been irregular; May was 6 per cent under April. Food products declined materially, especially in the extreme Northwest. More activity in paper and pulp was balanced by less in forest products. The only other advance was in stone.



Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

	South				West			
Industrial Groups	May, 1934	April, 1934	March, 1934	May, 1933	May, 1934	April, 1934	March, 1934	May, 1933
All Industry	**119.7**	**117.0***	**106.0**	**103.9**	**113.8**	**121.4***	**116.5**	**107.0**
Chemical products	157.0	166.4*	157.0	139.0	89.1	91.7	85.2	77.5
Food products	161.8	142.1*	123.7	149.8	102.4	117.3*	118.6	125.3
Iron and steel	185.0	155.2	133.5	93.8	.....	.....	.....	.....
Metal working	105.0	92.2	89.5	71.6	.....	.....	.....	.....
Metals group	149.4	127.4	114.2	84.1	78.0	78.7*	71.6	57.7
Forest products	46.0	46.7	42.1	43.3	161.0	175.0*	165.6	144.2
Paper and pulp	156.1	152.0*	161.0	148.0	178.6	168.5	159.5	139.2
Rubber products	97.5	101.7*	97.0	129.1	109.1	117.0	109.0	73.2
Shipbuilding	.....	.....	.....	.....	95.3	95.6*	113.0	98.1
Stone, clay and glass	130.0	137.2*	130.1	113.0	127.2	121.2	113.3*	104.2
Textiles	122.2	127.3	115.0	116.1	.....	.....	.....	.....

*Revision.

Further Progress in Electrical Manufacturing

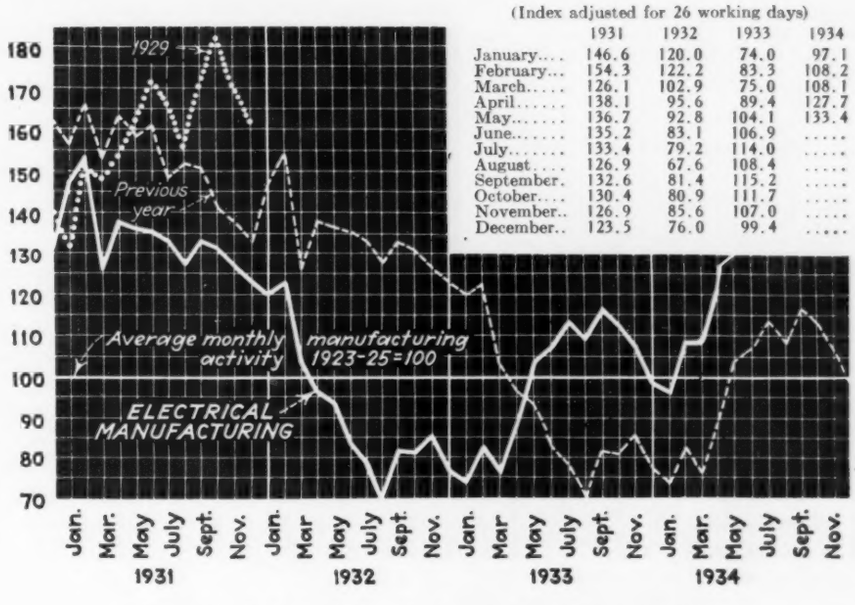
Operations in the manufacture of electrical goods picked up again in May, after the [illegible] increase announced a month ago. The rise over April exceeded 4 per cent, after an upward revision of the figure for that month to include late reports.

Progress during the past few months has been strong. Electrical energy consumption in these establishments as reported for May was 36 per cent greater than in January. The rise since that month has been uninterrupted. It has virtually restored the rate of activity prevailing three years ago, leaving the two intervening years far behind.

Virtually the entire industry participated in the month's progress. In the Mid-west, with few exceptions, the individual reports all point in the same direction; in the Middle Atlantic region gains ranging from 10 to 20 per cent are in evidence.

(Index adjusted for 26 working days)

	1931	1932	1933	1934
January	146.6	120.0	74.0	97.1
February	154.3	122.2	83.3	108.2
March	126.1	102.9	75.0	108.1
April	138.1	95.6	89.4	127.7
May	136.7	92.8	104.1	133.4
June	135.2	83.1	106.9	.....
July	133.4	79.2	114.0	.....
August	126.9	67.6	108.4	.....
September	132.6	81.4	115.2	.....
October	130.4	80.9	111.7	.....
November	126.9	85.6	107.0	.....
December	123.5	76.0	99.4	.....



Monthly index of electrical manufacturing activity

Conductor Load Limits Readily Determined

By E. P. PECK* and H. B. VINCENT, Jr.†

How many kva. can be handled by a given line, winter or summer, taking account of least favorable wind and ambient temperature as regards risk of annealing? These charts and tables give the answer in usable form.

Commercial aluminum and copper wire start to anneal at temperatures above 100 deg. C. and therefore 95 deg. C. can be taken as a safe operating temperature for transmission line conductors. The limiting current (under steady-state conditions) corresponding to this limiting temperature is dependent on the conductor resistance (which determines the heat generated) and on the heat it dissipates by convection and radiation. Applying the known magnitudes of these factors for commercial A.C.S.R. and copper wires, a group of curves has been set up covering conductors of representative

*Engineer Special Studies, Buffalo, Niagara & Eastern Power Corporation.
†Formerly with Buffalo, Niagara & Eastern Power Corporation.

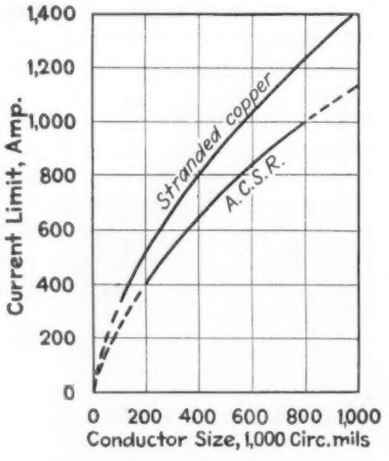


Fig. 1—Summer line loading limited by heating

System and station operators are guided in emergency and routine operations by permissible line loading for various sizes of conductors and for very light breeze. Summer air at 104 deg. F.

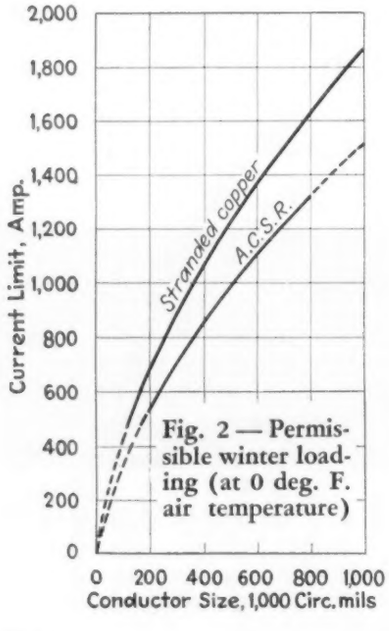


Fig. 2 — Permissible winter loading (at 0 deg. F. air temperature)

Table I—Summer Conditions of Conductor Loading

Permissible Current and Mva. Limits for 40 Deg. C. Air, 55 Deg. C. Rise, Conductor Temperature 95 Deg. C. and 2-m.p.h. Wind

Circ.mils	Current Limit Amp.	Corresponding Three-Phase Mva. Limit at Various Voltages 11 Kv.	13.2 Kv.	22 Kv.	33 Kv.	44 Kv.	66 Kv.	110 Kv.	132 Kv.	220 Kv.
A.C.S.R.										
167,800—3/0	358	6.83	8.17	13.7	20.5	27.3	41.0	68.3		
211,600—4/0	420	8.00	9.60	16.0	24.0	32.0	48.0	80.0	96	
266,800	485	9.25	11.1	18.5	27.8	37.0	55.5	92.5	111	
336,400	577	11.0	13.2	22.0	33.0	44.0	66.0	110.0	132	
397,500	640	12.2	14.6	24.4	36.5	48.7	73.1	122.0	146	
477,000	720	13.7	16.4	27.4	41.1	54.8	82.2	137.0	164	
605,000	837	16.0	19.1	31.9	47.8	63.8	95.7	160.0	191	319
636,000	860	16.4	19.6	32.7	49.0	65.4	98.1	164.0	196	327
715,500	935	17.8	21.3	35.6	53.4	71.2	107.0	178.0	213	356
795,000	1,000	19.1	22.9	38.2	57.3	76.4	115.0	191.0	229	382
Copper										
105,535—1/0	337	6.43	7.90	12.9	19.3	25.7	38.6			
133,077—2/0	395	7.52	9.02	15.0	22.6	30.1	45.1			
167,806—3/0	454	8.64	10.4	17.3	25.9	34.6	51.8	86.4		
211,600—4/0	531	10.1	12.1	20.2	30.3	40.4	60.6	101.0	121	
250,000	589	11.2	13.4	22.4	33.6	44.8	67.2	112.0	134	
300,000	666	12.7	15.2	25.4	38.1	50.8	76.2	127.0	152	
350,000	736	14.0	16.8	28.0	42.0	56.0	84.0	140.0	168	
400,000	803	15.3	18.3	30.6	45.9	61.2	91.8	153.0	183	
450,000	865	16.5	19.8	32.9	49.4	65.9	98.8	165.0	198	
500,000	930	17.7	21.2	35.4	53.1	70.4	106.0	177.0	212	
750,000	1,200	22.8	27.4	45.7	68.6	91.4	137.0	228.0	274	457
1,000,000	1,420	27.1	32.5	54.2	81.3	108.	163.0	271.0	325	542

Table II—Winter Conditions of Conductor Loading

Permissible Current and Mva. Loadings for 0 Deg. C. Air, 95 Deg. C. Rise, Conductor Temperature 95 Deg. C. and 2-m.p.h. Wind

Circ.mils	Current Limit Amp.	Corresponding Three-Phase Mva. Limit at Various Voltages 11 Kv.	13.2 Kv.	22 Kv.	33 Kv.	44 Kv.	66 Kv.	110 Kv.	132 Kv.	220 Kv.
A.C.S.R.										
167,800—3/0	478	9.09	10.9	18.2	27.3	36.4	54.6	90.9		
211,600—4/0	553	10.5	12.6	21.1	31.6	42.2	63.2	105.0	126	
266,800	646	12.3	14.8	24.6	36.9	49.2	73.8	123.0	148	
336,400	772	14.7	17.6	29.4	44.1	58.8	88.3	147.0	176	
397,500	861	16.4	19.7	32.8	49.2	65.6	98.4	164.0	197	
477,000	969	18.4	22.2	37.0	55.4	73.8	111.0	184.0	222	
605,000	1,110	21.1	25.3	42.2	63.3	84.3	127.0	211.0	253	422
636,000	1,140	21.8	26.2	43.6	65.4	87.3	131.0	218.0	262	436
715,500	1,230	23.5	28.2	47.0	70.5	94.0	141.0	235.0	282	470
795,000	1,320	25.2	30.3	50.5	75.6	101.	151.0	252.0	303	505
Copper										
105,535—1/0	450	8.56	10.3	17.2	25.7	34.3	51.5			
133,077—2/0	522	9.93	11.9	19.9	29.8	39.8	59.7			
167,806—3/0	606	11.5	13.8	23.1	34.6	46.2	69.3	115.0		
211,600—4/0	703	13.4	16.1	26.8	40.2	53.6	80.[illegible]	134.0	161	
250,000	783	14.9	17.9	29.8	44.8	59.7	89.[illegible]	149.0	179	
300,000	879	16.7	20.1	33.5	50.2	67.0	10[illegible]	167.0	201	
350,000	971	18.5	22.2	37.0	55.5	74.0	1[illegible]	185.0	222	
400,000	1,060	20.1	24.1	40.2	60.3	80.5	121.0	201.0	241	
450,000	1,140	21.7	26.0	43.4	65.1	86.8	130.0	217.0	260	
500,000	1,220	23.1	27.8	46.3	69.5	92.6	139.0	231.0	278	
750,000	1,570	29.8	35.8	59.7	89.5	119.0	179.0	298.0	358	597
1,000,000	1,860	35.5	42.6	71.0	106.0	142.0	213.0	355.0	426	710

sizes. These curves become the guide for system operators and engineers in comparing line loading with maximum safe loading.

An index of safe loading under *summer* conditions is found in Fig. 1 and Table I. These are for the conditions:

Air temperature	40 deg. C. (104 deg. F.)
Conductor temperature	95 deg. C. (203 deg. F.)
Wind velocity	2 m.p.h. (2.93 ft. per second)

Similarly an index of safe loading under *winter* conditions is presented in Fig. 2 and Table II. These are for the conditions:

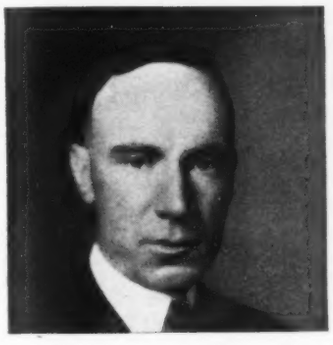
Air temperature	0 deg. C. (32 deg. F.)
Conductor temperature	95 deg. C. (203 deg. F.)
Wind velocity	2 m.p.h. (2.93 ft. per second)

Regarding the 2 m.p.h. wind assumed it can be said that under outdoor conditions velocities of less than 2 m.p.h. are very uncommon unless the location is rather completely sheltered. This wind is assumed to be a horizontal one blowing across the line. The curves and tables are based on 60-cycle current and the corresponding conductor resistances. This means that they can be used for 50-cycle, 25-cycle or direct-current with some margin.

Three sources of data and formulas were used and compared in arriving at the results given here: (1) "Current-Carrying Capacity of Bare Conductors for Outdoor Service," by O. R. Schurig and C. W. Frick, General Electric *Review*, March, 1930; (2) "Current Capacity of Wires and Cables," by G. E. Luke, *Electric Journal*, April, 1923; (3) Chart on A.C.S.R. temperature rise, prepared by the Aluminum Company of America in 1929. All three sources give data for still air conditions and comparison showed that they do not differ from their average by more than 2 per cent. Luke's still air values for an air temperature of 40 deg. C. and conductor temperature of 95 deg. C. were multiplied by 1.25 to obtain values for a 2-m.p.h. wind; the factor 1.25 is given by Edith Clarke. An average was taken between these and the Schurig-Frick values to obtain the limits in Fig. 1 and Table I. The limits in Fig. 2 and Table II were calculated directly from the Schurig-Frick formulas.

Interchange Benefits Utility and User

After Two Years of Experience, This Large Power Consumer Tells What Interchange Has Accomplished



By **WILLIAM A. HANLEY**
Director of Engineering, Eli Lilly & Company, Indianapolis

IN APRIL, 1932, Eli Lilly & Company decided that a steam purchase and electricity interchange contract with the Indianapolis Power & Light Company was the best of four possible plans for heat and energy supply to their Indianapolis plant, so a contract was entered into which has been in operation to the satisfaction and profit of both the utility and our company. Some pertinent details of this contract will be outlined and one may check its advantages by a comparison of the operating cost data given in the statement of 1933 operation under the contract with what he thinks would be good performance and costs for isolated boiler and generating plant of sufficient capacity and reliability to maintain constant service. These comparisons should include interest, depreciation, taxes, insurance and administrative salary charges.

The four plans that the Lilly company had to choose from for its heat and energy supply were:

1. Install new boilers in existing power house. Use existing engines to generate direct current. Buy all alternating current. New investment required, $132,000. Ten-year total cost, $2,184,408.
2. Install new boilers and turbines in existing power house. Generate all current. New investment required, $248,500. Ten-year total cost, $1,630,959.
3. Build new plant for all heat and power demands on new site. New investment required, $425,000. Ten-year total cost, $1,617,076.
4. Buy all steam. New turbines in existing power house for heat and pressure reduction of steam. Interchange electricity

This large industrial with its own plant required more capacity in power and process steam and saw four possible solutions of its problem. It made a reciprocal contract with the local utility and then kept a careful record of results. Distinct advantage is seen both to the manufacturer and the power company. The record is for the information of other engineers in industry and other central stations. Such services may well be expanded.

with power company. New investment required, $85,000. Ten-year total cost, $1,546,091.

Contract terms outlined

The fourth plan, with its comparatively small new investment of $85,000 and its saving of $70,985 in ten-year cost over the next most attractive course (3), was expressed in a ten-year contract with the utility, by which the Lilly company agreed to buy not less than $50,000 worth of steam in any year and to pay $1.10 per thousand pounds of steam for the first 30 hours use of the billing demand per month, $0.40 per thousand pounds for the next 90 hours use, $0.25 per thousand for the next 240 hours use and $0.23 per thousand for excess over 360 hours use. Steam demands are determined for individual months, bills are payable monthly, with a 2 per cent cash discount, and the prices for the unit quantities are modifiable by a fuel clause which it is not necessary to detail here. Steam is furnished at a delivered minimum guaranteed pressure of 175 lb. and with 100 deg. F. superheat through a 6,000-ft. pipe line from the utility power station and is reduced to 5 lb. pressure in a 2,000-kw. turbine and to 100 lb. in a 500-kw. unit for use in the manufacturing processes of the Lilly company.

The turbo-generators are paralleled with the utility electricity system and the energy they produce may be partly or wholly used by the Lilly company or be absorbed into the utility system. In effect, the turbines operate according to the steam demand without any reference whatever to the Lilly electrical load. At any time the load may be more or less than the turbine output. If it is more, the utility supplies the difference; if it is less, the utility takes the surplus. Unlike the steam billings, which are monthly, the electricity accounting is annual.

At the end of the year, if the Lilly company used more energy than was generated in its plant, it pays at the rate of 1.35 cents per kilowatt-hour. If use was less than generation the utility pays the Lilly company at the rate of 0.25 cent per kilowatt-hour. Thus the Lilly company receives credit at its buying price for such energy of its own production as is applied to its own use, while any surplus is taken by the utility at roughly its own fuel cost. The utility has no control over the operation of the Lilly plant. It was expected that the maximum steam demand in the first year would be 60,000 lb. per hour, rising to 100,000 lb. per hour in the tenth year.

Unforeseen contract advantages accrue

Quite apart from the operating economies it has accomplished, the contract has already demonstrated its value to the Lilly company in a rather striking instance. In August, 1932, certain changes were made in manufacturing processes, with the result that steam usage was decreased about 300,000 lb. per day. This reduction was immediately reflected in a significant decrease in the steam bill. Had the steam been generated in the Lilly power house the reduction would have caused only the slight decrease in cost, represented by the saving in fuel. There would have been no decrease in the cost element due to fixed charges and the cost of operating labor would have been unaffected.

Undoubtedly the satisfaction of both parties with the arrangement is due directly to the fact that both sat in the contract negotiations with open minds and with complete consideration for the other party and his problems and without any plan that would work to the disadvantage of the other. The result was an agreement extremely simple in form and statement and containing no clauses that tacitly impute to both parties an inclination toward bad faith. Speaking for Eli Lilly & Company, the writer states complete satisfaction with the way the agreement has worked out so far and anticipates that it will continue to be satisfactory. That the power company is soliciting other contracts on the same basis at this time speaks for itself.

Advantages of Power Interchange

FOR THE POWER COMPANY:

A source of revenue yielding a minimum of $6,500 per month to a maximum of $9,000 per month for all twelve months of the year.

A guaranteed income for steam alone of $50,000 per year for a period of ten years.

A source of revenue requiring a minimum of accounting, meter reading and cost of collection.

FOR THE MANUFACTURER:

A source of power and steam with much greater reliability than could be attained in an isolated plant.

A minimum of investment.

No stand-by power plant losses.

An exceptional heat balance since current is generated only when steam is necessary for processes, and all current must be absorbed by the power company when generated in excess of electricity demands.

An arrangement for obtaining electricity and steam economically should the relation of steam demand to electricity demand be thrown out of balance by any unforeseen conditions.

The elimination of coal and ashes from around a plant where cleanliness is imperative and where thousands of dollars per year are spent on cleaning and painting.

What the Industrial Plant Reported for 1933

Pounds of steam purchased and used by Lilly company. (The condensate from the steam became the property of the Lilly company)	165,373,000
Kw.-hr. generated by Lilly company and used in Lilly plant	1,227,000
Kw.-hr. purchased from power company less current returned	2,363,000
Kw.-hr. total usage by Lilly company	3,590,000

Greatest steam demand 51,000 lb. per hour. Greatest kilowatt demand 1,400.

Power House Costs, 1933

Salaries—pro rata	$ 2,976.00
Wages	7,015.00
Repairs	417.00
Supplies	462.00
Water, power, compressed air	199.00
Interest, depreciation, taxes, insurance	11,000.00
Net paid for steam and electricity to power company after adjustment for power returned	92,793.00
Total	$115,862.00

For a cost of $115,862.00 the Lilly company obtained 165,373,000 lb. of steam at an average of 230 lb. pressure and 70 deg. F. superheat. 3,590,000 kw.-hr. net used in Lilly plant and about 20,000,000 gal. condensate. About 60 per cent of the condensate found useful purpose and replaced water formerly softened and heated at a cost of about 25 cents per 1,000 gal.

The above results would have shown greater economies except for power house changes in Lilly plant, which suspended all current generation for a period of 30 days in May and June.

Electrical Layouts for Production Economy

Straight Line and Departmentalized Manufacturing Is on the Way Out. Electric Power and Control Are Making Possible a Better Method

By W. S. RISSER
Works Equipment Department, Westinghouse Electric & Manufacturing Company

MODERN factory methods, with the necessity for high-speed production and low costs, demand that material should progress through its various operations with the least possible delay. This involves laying out the departments so that the machine tools will be arranged to give an uninterrupted flow of production. The present layout of a motor frame machining group is shown in the accompanying line drawing. This was changed from its former set-up in order that the various machining operations could be performed in their proper sequence with a minimum of time and effort. After a study had been made it was found that by properly locating these machines it would be possible for one operator to tend more than one machine, instead of having an individual operator on each machine, as was formerly the case, thereby reducing the cost of the parts being manufactured and securing a more effective flow of work.

These machines were all motor-driven, each one having its individual motor or motors and control equipment. Because of this they could be arranged with the sole idea of getting the most economical set-up. This also conserved the available floor space and enabled conveyors to be used most advantageously.

It will be noted that some of the machines are located next to the aisle near the center of the bay and others are at right angles to each other, so that it would have been rather difficult and expensive to erect the necessary overhead structure on which to mount a lineshaft in order to drive these machines as they are now located. A lineshaft would also have interfered with the operation of a crane which runs the length of the aisle. Several jib cranes were erected on which are mounted electric hoists for handling work in and out of the machines.

Over one group of machines a light monorail crane was erected on which are mounted electric hoists for handling work. This is made more effective by not having belts or lineshaft to interfere. The cost of maintenance of belts and lineshaft was also eliminated. Another factor to be considered is that by having each machine motor-driven any one can be operated by itself, if necessary, independent of the others, without having to run a long length of lineshaft.

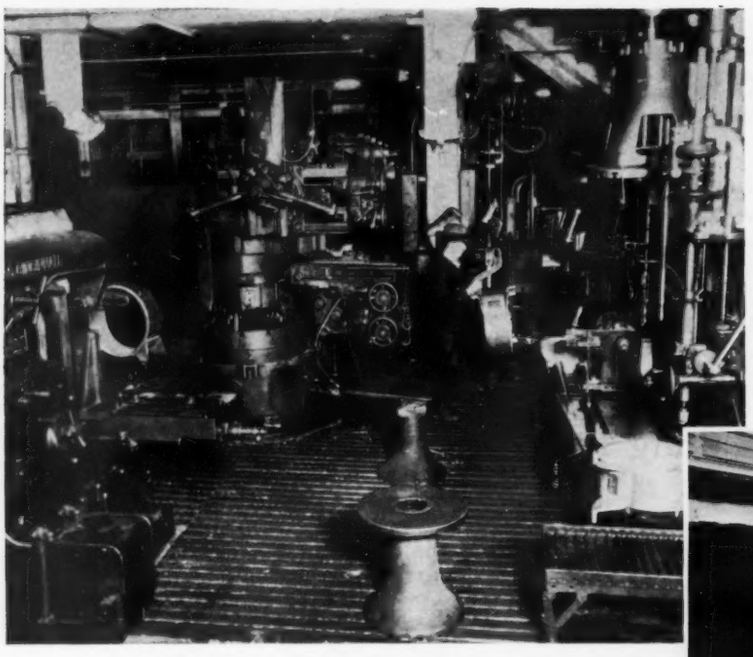
Modern production has changed greatly with respect to factory assembly and use of electrically driven machine tools. Maximum efficiency and economy must be obtained and the author of this paper shows how to apply the principles to a specific application. Modernization of industry involves the use of these ideas and the new equipments described. These principles are applicable to many industrial production jobs.

Uses two types of motor drive

It will be noted from the accompanying illustration that the absence of belts and lineshaft gives a better general illumination. In addition to the general illumination, each machine is equipped with an individual light which is mounted on an adjustable bracket. This bracket, mounted on the machine in a convenient location, can be turned in any direction to enable the operator to throw light on the surface being machined when more light is needed than is furnished by the general illumination. Light is an important factor in industry and one which should not be neglected. Quantity production, together with the necessity of working to close limits, demands that the workman have good light. Since daylight varies with weather conditons more attention is being given to electrical illumination which can be maintained at a constant value.

Part of the machines in this group are driven by alternating-current, constant-speed motors and part by direct-current, adjustable-speed motors. The factor which determined the use of a.c. or d.c. motors was whether the machines had some mechanical means for changing spindle speeds or whether it was to be accomplished by adjusting the speed of the motor. Both direct current and alternating current were available in this department, and the bus lines were of sufficient capacity to carry the load so that it was not necessary to reinforce them.

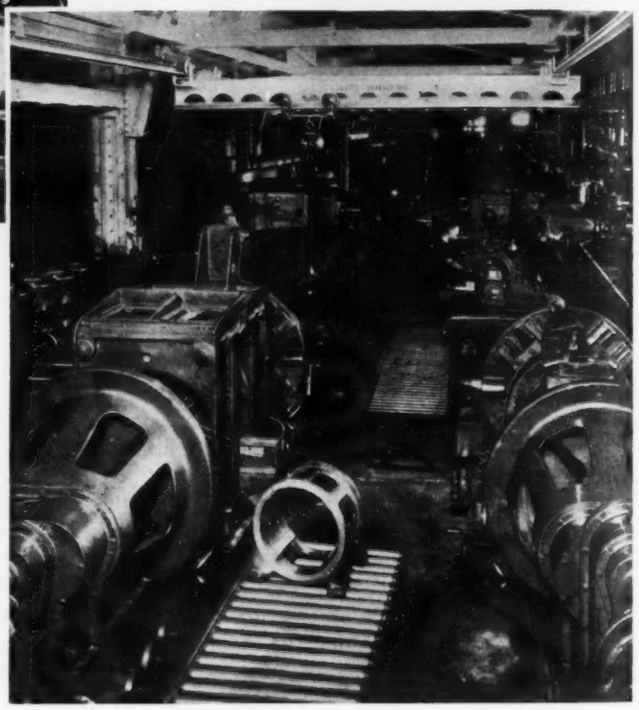
The lathes are equipped with adjustable speed d.c. motors having a four-to-one speed range. All changes of speed are secured by varying the field of the motor by means of a rheostat. Changes of speed can be made in small increments, thus the correct cutting speeds for different



A group of machines located with respect to each other to permit a single operator to get most economical production

Monorail crane and hoist for lifting frames in and out of machines

This view also shows better lighting due to absence of overhead belts and shafting.



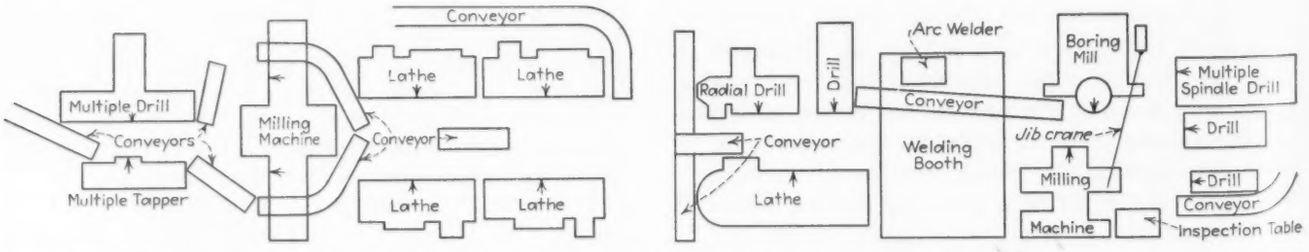
sizes of work. In some cases these rheostats are calibrated and spindle speeds marked on the face of the rheostat for different positions of the handle.

How to select control

Selection of the proper control equipment for motor-driven machines is as important as the selection of the proper motor. The wrong application of control may impair the efficiency of the machine and operator, with the result that production will be reduced instead of increased. Most of the machines in this particular layout have magnetic starters, which are used in conjunction with push-button master switches mounted at some point within easy reach of the operator. This enables him to start and stop the machine with a minimum of effort, which is a factor to be considered when he is operating more than one machine.

Magnetic control prevents the operator from willfully or unknowingly abusing the motor, which may be possible with manual starters. The average machine tool operator is not familiar with the operation of electrical equipment and automatic control helps to simplify the work of the operator.

On several machines in this layout there were more than one motor and it was necessary to interlock the control of these motors so that they would function in the proper sequence. In such cases manual controllers were out of the question because these operations had to be performed automatically. As an example there is a three-way drilling machine for drilling motor frames which has three heads, each one driven by a 3-hp. adjustable-speed, direct-current motor, and one hydraulic pump for feeding these heads, which is driven by a 5-hp. constant-speed motor. The control for all motors is automatic and the circuits are interlocked so that all three head motors must be in operation before the feed pump motor starts. This eliminates the possibility of drill breakage, due to forcing a number of non-rotating drills against a casting. Machine limit switches are mounted on the machine, each limit switch being actuated by one of the drilling heads, so as to



Layout of department showing location of machine tools and conveyor grouped to give efficient production at a minimum cost

stop all motors when the last head has reached its normal position after one cycle of operation. All the operator has to do is to press a master start button and the cycle of operation is done automatically.

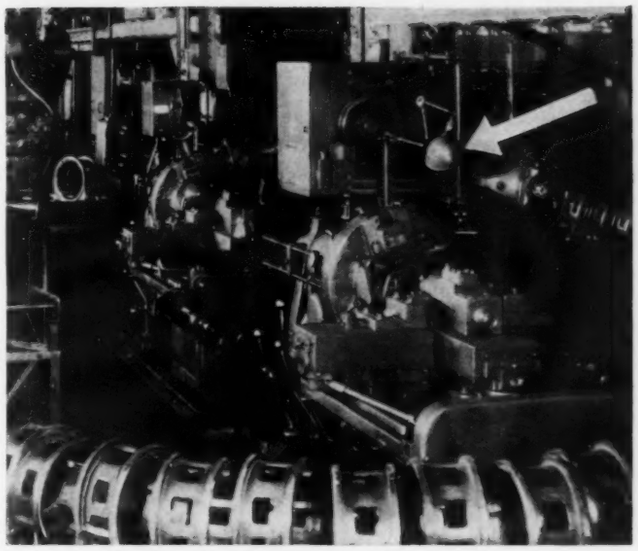
Another example is a two-head multiple tapping machine, each head horizontal and facing the other and each one driven by a 7½-hp. reversing a.c. motor. Automatic control and limit switches provide for reversing the motors after tapping in order to back out the tap. The heads then move back to their starting postion, ready for another cycle.

Controls are mounted on machines

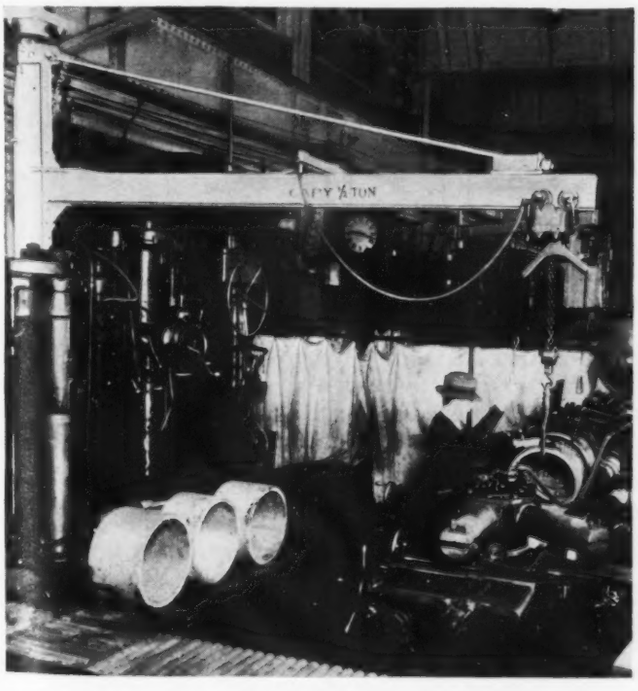
Control equipment is all mounted on the machines, with the exception of those machines driven by several motors, and the control for these motors has been built in one large cabinet. In this case the cabinet is either placed on a rack or column near the machine.

The advantage of mounting the control equipment on the machine is that it is easier and cheaper to wire and also saves floor space. In the case of magnetic controllers the control panel itself is mounted as close to the motor as possible in order to save wire, conduit and time. Push buttons and rheostats are placed near the operator's position. All wires from the main bus line to the machine are in solid conduit and all wiring on the machine is in either solid or flexible conduit. This makes for safety both to the operator and the equipment.

This particular group of machines is located on the ground floor and the main bus system for power supply is located overhead. To get power to the machines feeders were run in conduit from the main bus down the building columns in each bay to a disconnect switch of sufficient capacity to take care of the machines in that bay. From this switch a conduit was run to each individual machine, this conduit being placed under the floor so as to be out of the way and make a neater installation. Since all control equipment is mounted on the machine only two wires in the case of direct current and four wires in the case of two-phase alternating current are necessary from the column switch to the machine. Should it be desirable at any future date to move any of these machines it will only be necessary to disconnect the power supply coming to the machine without disturbing any of the control or wiring on the machine itself.



An adjustable light bracket is mounted within easy reach of the operator of this lathe



Jib crane for handling work in and out of machines

Better Tool Inspection Reduces Field Accidents

Finding that an unduly large number of accidents to maintenance forces was caused by insufficient tool inspection and rehabilitation, the New England Telephone & Telegraph Company has established a routine designed to insure the elimination of defective tools, the use of only the proper tools for the job in hand, the proper use of the tools suited to the needs of the occasion and the employment of only company-owned tools. At a recnt public utility session of the New England Safety Conference, J. H. Serror and F. J. Bayha of the Providence district of the New England company outlined the policies which have cut down tool accidents to a low number. These policies are equally applicable to power and communication systems.

To obtain 100 per cent supervision over tools it was required that none individually owned should be used. Instructions and practices governing the use, care and maintenance of tools were issued. Through the efforts of the company's safety instructors every mechanic was made familiar with the proper use and care of all tools used by him. Study of accident reports by safety supervisors was then made, and as improvement appeared a tool inspection routine was set up. All tools are inspected semi-annually, the safety supervisors visiting each crew and examining for defects all tools and motor-vehicle equipment. A system of forms provides for list-

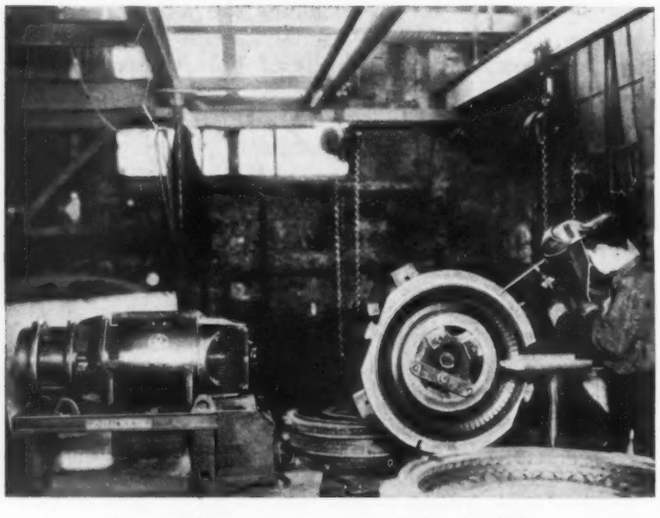
ing defective and missing tools, points the way toward replacements under the direction of the foreman and check-ups by safety supervisors and the avoidance of repeat items.

Defective pieces are returned tagged to the stockroom, which examines the tools and parts, seeking to determine the cause of defects. This has led to a much more accurate use of tools for specific tasks. Orderly location and placing of tools are followed up closely, and salvage is naturally sought when feasible. Tools and equipment are unhesitatingly condemned if found in any way unsafe. No tools are abandoned or junked in the field, but all are returned to the stockroom unless lost. Ladders and climbers are inspected weekly and ladder accidents have become rare, while climber accidents are now few and far between.

Arc Welding Permits Big Saving in Modernizing Tire Molds

An estimated saving of between $15,000 and $18,000 will be realized by the Mansfield (Ohio) Tire & Rubber Company in bringing its entire inventory of tire molds up to date by arc welding. The saving is obtained by eliminating an expensive "bullringing" operation and in speeding up the work. The welding, in charge of J. N. Williard, contractor to the company, goes on nearly 24 hours a day, and it is estimated that between five and six months will be required to complete the job.

Involved in the changeover work are the annular grooves or rabbets which register the halves of the molds, these rabbets originally having a right-angled profile. To make the molds close properly without wear under constant use the rabbets are being given a beveled instead of a right-angled form. This requires cutting away the female half of the mold to the desired angle and building up and machining the male half to the same angle. A 200-amp. General Electric arc welder and G.E. type M welding electrodes are used to deposit the additional metal required on the male half of the mold.



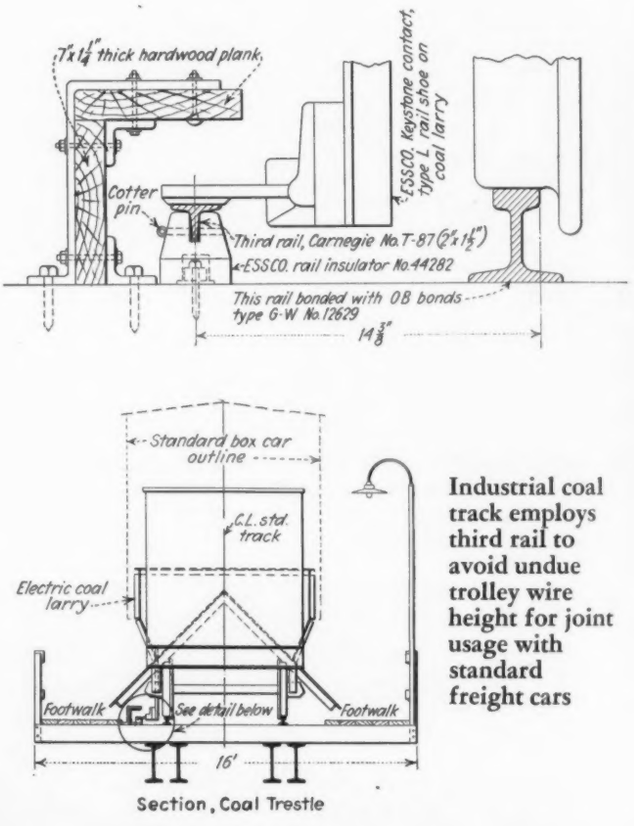
Arc welding set-up employed to build up the rabbets in tire mold modernization

· · · INDUSTRY

Modified Third Rail System Aids Industrial Coal Handling

By A. P. SCHNYDER
Electrical Engineer
with George F. Hardy, Consulting Engineer, New York

Third rail traction supply is a distinctive feature of the coal transfer trestle of a Canadian paper mill on the seaboard. The mill is about 1,500 ft. from the tidewater docks, too far to justify the use of a conveyor, and consequently rail and car transfer was adopted. The reason for using the third rail was that the track is standard gage, tying in with the railroad at the mill end, and freight cars operate over a portion of the trestle track; a trolley wire would have had to be unduly high in order to clear the freight cars adequately. The third rail is covered for the protecion of employees who have to work near the tracks.



Industrial coal track employs third rail to avoid undue trolley wire height for joint usage with standard freight cars

Conventional third rail construction as used by traction systems was modified as shown in the accompanying sketch. The 250-volt d.c. supply for the 35-hp. motor on the coal car is obtained from a 21-kw. motor-generator set. More for strength than for carrying capacity, a Carnegie T-87 rail section of 2x1½ in. was used. The car was a standard trolley type car redesigned for third rail operation.

PRACTICES IN BRIEF · · ·

Sheet-Rubber Handling Controlled by Photo-Cells

By H. H. RAYMOND
Consulting Engineer the Stanley Works, New Britain, Conn.

Rubber sheeting as used in an Eastern shoe factory is so sticky that if it is allowed to touch the floor or to foul as it unrolls from a reel to a conveyor disaster results. To prevent this, three photo-electric cells are mounted on a frame between the reel and the conveyor opposite spotlamps placed 1 ft., 3 ft. and 4½ ft. above the floor. Continuous beams of light pass from the spotlamps on the pipe framing across the U of the frame to the photo-electric cells at a downward angle of about 10 deg. One of these cells is shown clamped to the left-hand upright in a set-up made before the two other cells were placed in final position in the same vertical line.

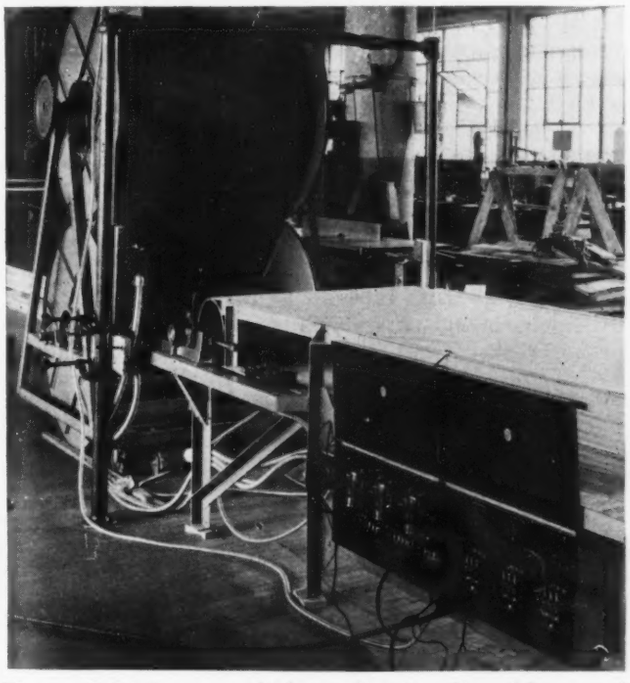


Fig. 1—Initial set-up of photo-electric cell and lamp unit to control movement of sticky rubber sheeting from reel to conveyor

In the permanent layout three photo-cells were mounted one above the other to stop the reel, start the reel and stop both reel and conveyor under the conditions described.

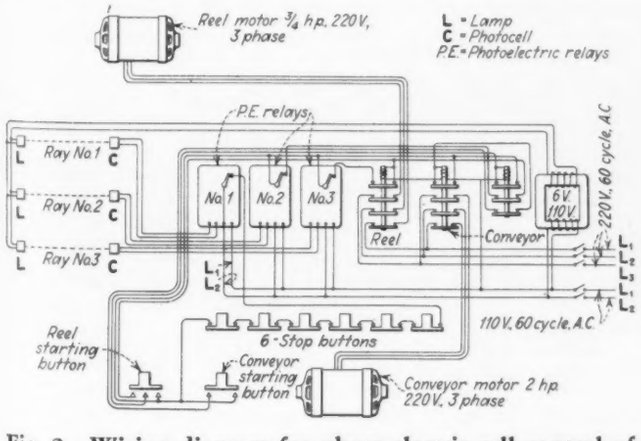


Fig. 2—Wiring diagram for photo-electric cell control of reel and conveyor to safeguard sticky and fragile rubber sheeting from injury

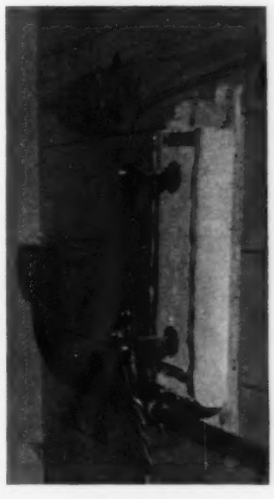
As the rubber roll loops downward from the power-driven reel at the left (Fig. 1), the reel turning at constant speed, the slack festoons downward toward the floor. The rubber is highly fragile besides being sticky. The speed of the reel is slightly above that of the horizontal conveyor shown (center to right). As the loop approaches the floor within 1 ft. it interrupts the light ray passing from the lowest lamp to the lowest photo-cell, and this actuates the photo-cell relay and stops the reel motor. The conveyor gradually pulls up the slack and when the rubber sheeting loop reaches a height of 3 ft. above the floor it interrupts the ray between the intermediate lamp and its cell, starting the reel motor and again delivering the sheeting toward the conveyor without stoppage of the conveyor.

Occasionally the sheeting becomes caught on the reel and this sweeps the rubber sheet upward into the air. This interrupts the light ray between the top lamp and the corresponding photo-cell, and appropriate relays shut down both reel and conveyor motors to prevent extensive damage. The conveyor is about 30 ft. long and is equipped with stop buttons for emergency service and protection of workers.

Sprinkler Valve Freezing Prevented by Electric Heat

The Brunswick-Balke-Collender Company in its plant at Muskegon, Mich., has a number of sprinkler valves located in unheated parts of its buildings. In order to prevent these valves from freezing, inclosures were built around them with several 100-watt lamps inside. These lamps accomplished the desired results, but the cost of lamp replacements was excessive.

Consequently, small 300-watt strip heaters have been substituted, mounted on the wall of each inclosure. Now for a very few cents a day a clean, safe, unfailing source of heat supplies above-freezing temperatures to these sprinkler valves despite the coldest of sub-zero weather.



Small strip heater for sprinkler valve inclosures

Substituted for lamp bulbs previously used, it provides more dependable heat.

Three Ways to Insure Industrial O.C.B. Adequacy

By R. I. POWERS
Relay Engineer Milwaukee Electric Railway & Light Company

When system short circuit capacities increase industrial customers object to buying larger oil breakers for all cricuits. They need not. Here's the scheme that solves the problem in Milwaukee.

In industrial substations it frequently happens that, due to system growth, the oil circuit breakers are no longer able to rupture the maximum short circuit that could occur. In such cases it is imperative that the service, or main oil circuit breaker, be replaced with one of adequate rupturing capacity. However, the cost of replacing all breakers serving apparatus connected to the substation bus may be prohibitive. At best even the suggestion of such a change will bring loud protests from the customer. The problem of operating these feeder breakers safely presents a problem which, although troublesome, can be met by properly applying protective equipment.

If the feeder breaker controls a transformer the protective scheme shown in Fig. 1 can generally be used. The current transformers are connected in the low-tension leads of the transformer and the relays trip the primary oil circuit breaker. The only faults the breaker will be called upon to interrupt are those which occur on the low-tension side of the transformer. The impedance of the transformer will generally limit the fault current to a value which the oil circuit breaker can interrupt. If the transformer is equipped for changing ratio this scheme is not satisfactory. This condition is encountered in connection with arc furnace transformers where different voltages are used for melting down and refining. The ratio change is generally made on the high-tension side of the transformer and consequently use of low-tension protection results in trying to meet two conditions with one set of protective equipment. Furthermore, excessively large current transformers are frequently required.

Another solution lies in the use of time-delayed relays on the feeder breaker. If the service breaker is equipped for instantaneous tripping, while the tripping of the feeder is delayed, say 0.25 second, the service breaker will open ahead of the feeder breaker and interrupt the fault. The only selectivity in a scheme of this kind lies in the difference in current settings for the service and feeder breakers. This band is usually very narrow and as a result almost all faults on the feeder will open the service breaker and cause a total outage.

A third and probably the most satisfactory solution to this problem lies in the use of time-delayed relays in conjunction with instantaneous cut-off relays for the service and feeder breakers. The connection is as shown in Fig. 2. A time delay of say 0.5 second is used for the service relays and 0.1 second for the feeder relays. The instantaneous cut-off relays are set to operate on a value of current slightly less than the maximum rupturing capacity of the feeder oil circuit breaker. For all faults below this value natural selectivity exists between feeder and service breaker. If, however, the fault exceeds the rupturing capacity of the feeder breaker the instantaneous cut-off relays operate and prevent the feeder breaker from opening. After a short delay the service breaker opens the circuit. In all the figures the current transformers are shown "Z" connected. With this connection only two relays are required per breaker. The connection of the current transformers can be altered to suit local requirements.

In Figs. 1 and 2 it has been assumed that batteries were available for tripping the oil circuit breakers. It frequently happens that no batteries are available and tripping energy must be obtained from the current transformers. Fig. 3 shows how the connection of Fig. 2 can be altered to accomplish this.

A feeder breaker with adequate rupturing capacity in an industrial substation will handle most of the faults it is called upon to interrupt. If the few cases it cannot handle can be disposed of, considerable saving in breaker replacement expense should result. Protection as described also makes possible the use of second-hand equipment which could not otherwise be safely used. This has certain possibilities from a promotional point of view.

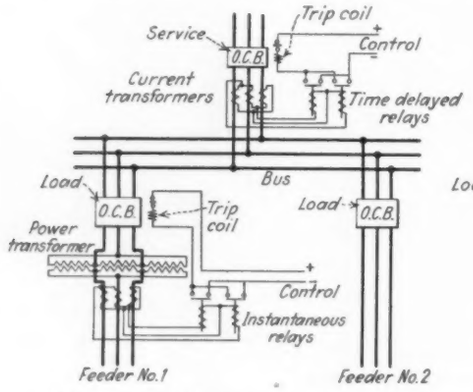


Fig. 1—Feeder breaker operation confined to secondary faults

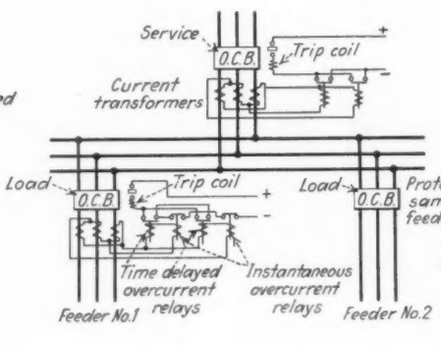


Fig. 2—Major fault opens service breaker only

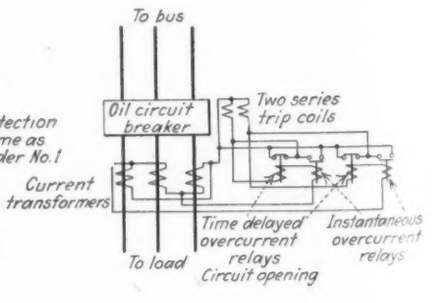


Fig. 3—Where d.c. tripping current is not available

LETTERS TO THE EDITOR

Suggests "Megawatt-Hours"

To the Edtor of the ELECTRICAL WORLD:

Facing page 145, in the May, 1934, number of the Bulletin of the Edison Electric Institute, there is the usual page containing "Statistical Data."

Are there not, on that page of statistics, 56 groups of naughts—three naughts in each group—which need not have been printed, if the term "megawatt-hours" were used instead of kilowatt-hours"?

Can you tell me if the term megawatt-hour (a) has been extensively used; (b) has its use been advocated, and (c) what are the objections—besides the customary use of "kilowatt-hour"—to its use?

JOHN MURPHY.

Ottawa, Canada.

[This letter is published, not in criticism of the excellent statistical service of the E.E.I., but because it applies also to some of the material that has appeared in ELECTRICAL WORLD. The use of the unit "megawatt-hour" was suggested in an editorial on page 867 of the issue of May 4, 1929, and some statistics have been published on that basis. Perhaps the best way to have the practice generally adopted will be simply—to adopt it.]

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The More Critical with Meter Jewels the Better

To the Editor of the ELECTRICAL WORLD:

We differ in some degree with some of the findings of those whose experience went to make up part of Mr. Brown's letter (ELECTRICAL WORLD, May 26, 1934, page 773), particularly as regards the number of jewel rejections by the various power microscopes used. The company using the eight-power microscope and rejecting about 30 per cent of worn jewels would pass jewels that should never be in service. The company using the 60-power microscope with 55 per cent rejects as defective seems to be more on the right trail, and were it using a different method of lighting the rejections would probably be higher.

It is quite conceivable that if magnification is carried high enough all jewels would be rejected as imperfect. Experience seems to dictate that powers of magnification in the neighborhood of 40X are about right to give results consistent with good judgment.

What we have had to say about jewels also applies in the same degree to steel balls and pivots, and it is our opinion that these two items should be regarded as one, rather than two separate items.

It is the opinion of the meter engineer of one of the largest utilities in the country that, based on a six-year periodic test interval, it is well worth the cost of a few extra cents per year to install new jewels and pivots at each test period, returning the old ones to the meter shop for inspection and repolishing if found to be worn. This average cost is quickly offset by a gain in registration of but one kilowatt-hour a year in most companies. This gain is obtained at loads less than 10 per cent through improved performance. The average of tests made on eleven meters, taken from the system, with jewels showing wear from very slightly worn to badly worn, show a decrease in accuracy of 0.3 per cent at 10 per cent load and 1.5 per cent at 2 per cent load.

Some time ago it was our privilege to have received a rather lengthy and enlightening letter on the subject of periodic jewel and pivot change from one to whom the paternity of this system is usually credited. He said:

" . . . it is difficult to show the inaccuracies due to bad bearings with the facilities and the test methods usually used. The meter is jarred by the tester when connecting up his instruments. Oftentimes an insignificantly slight jar will cause a meter to change from 70 to 110 per cent registration at light load and it will grind its way back to 75 per cent registration in a few hours after the test.

"Satisfactory cleaning and oiling on the consumer's premises are impossible. Every attempt to clean a bearing on location does more harm than good because it disturbs the abrasive material which has caused the trouble, but does not remove it, and it is about five times as expensive as shop cleaning where a uniformly good job can be done.

"Hundreds of meter superintendents still test jewels with a needle in the field after they have made a disastrous attempt to clean the cup. It is hard enough to make a good jewel cup and it is harder to keep it in that condition, and I know of no other one thing more disastrous to a jewel cup than this same needle test."

In conclusion, may I suggest that it lies with the meter engineers themselves as to what should be accepted as a standard for meter jewels, but our suggestion is that the more critical they are, the better off they and their meters will be.

HAROLD J. CUNNINGHAM,
Treasurer.

Industrial Jewel Company, Inc.,
Waltham, Mass.

[Mr. Cunningham says his offer to send drawings of a microscope inspection device for jewel inspection (ELECTRICAL WORLD, November 18, 1933) to any one interested still holds good.]

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Grooved Collector Rings Patented Abroad

To the Editor of the ELECTRICAL WORLD:

Our attention has been directed to the article appearing on page 613 of the April 28, 1934, issue of ELECTRICAL WORLD under the heading of "Grooved Collector Rings Save Brushes." We have read with interest the article in question and it would perhaps interest you to know that this application was the subject of a patent taken out in the joint names of J. A. Colombi and the Brush Electrical Engineering Company, Ltd., on May 16, 1928, for the United Kingdom, Patent No. 317424, and on May 15, 1929, for Sweden, Patent No. 68779.

WILLIAM PEARSON, Jr.,
General Manager.

The Brush Electrical Engineering Company, Ltd., Loughborough, England.

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Deposits to Go to the State

To the Editor of the ELECTRICAL WORLD:

In the issue of the ELECTRICAL WORLD for June 9 there is on page 855 a brief paragraph about a new law of New York State regarding customers' deposits which seems to me misleading. The paragraph is headed "Customers' Refunds" and reads as follows:

> Under the provisions of the Burchill bill, just signed by Governor Lehman, customers may obtain from the state on presentation of proper proof of ownership deposits made with public utility companies.

A bill was introduced by Senator Burchill and became a law which amends the transportation corporations law by adding to it a new section No. 13(a), the substance of which is that gas and electric corporations must file with the Public Service Commission each year a report of all consumers' deposits which the electric or gas corporation held at that time and which had been unclaimed for ten years or more. The act further provides that deposits unclaimed for fifteen years or more shall be paid with interest into the Treasury of the state of New York.

There is nothing in the Burchill bill above summarized which provides for the return to consumers by the state of deposits which had been previously paid to the state, as unclaimed, by the utility which had collected them. One of the serious defects in the law, in the opinion of many lawyers, is the lack of the usual provision in laws governing escheat to the state for indemnity to the utility corporation in case a claim should be made upon it for deposits already turned over to the state as required by the act. Of course the law does not require the return of consumers' deposits by the utility to the consumer presenting evidence of ownership, because the presentation of such evidence of ownership would, without any new statute, invariably result in the return of the deposit. The utility could not possibly do otherwise.

The whole purpose of the law, and its effect, if it is enforceable, is not, as your summary of it would indicate, to guarantee to consumers the right to obtain their deposits from the state if they could not obtain them from the public utility company, but to transfer from the treasury of the utilities to the treasury of the state substantial sums of money which have been legally held by the utility companies subject only to the claim of the depositors, supported by proper proof. Some of the older utility companies have unclaimed consumers' deposits held since 1850.

H. C. HASBROUCK.

New York, N. Y.

NEWS OF THE WEEK

Knoxville Deadline Passed; No Action

Electric Bond & Share reports no progress in negotiations with T.V.A. Alabama coal and ice companies seek injunction against appliance program.

Although the "deadline" for acceptance of the Tennessee Valley Authority's offer to buy the Knoxville properties of the Tennessee Public Service Company came and went this week, no announcement was forthcoming either from the Electric Bond & Share Company or from T.V.A. regarding the outcome of the authority's ultimatum (ELECTRICAL WORLD, June 16, page 886). Only the following uninformative statement was issued by Electric Bond & Share Company regarding the negotiations: "Representatives of the Tennessee Valley Authority and of the Tennessee Public Service Company have thus far been unable to reach a conclusion, but efforts in this direction are being continued."

Legal obstacles in the path of T.V.A.'s electrical development of the Tennessee Valley continued to rear themselves, when 32 Alabama ice and coal companies filed suit in the Federal District Court seeking an injunction against the sale of electric refrigerators through the use of public funds or credit in competition with their business. The suit closely followed the rendering of an opinion by Mississippi's Attorney-General that the Electric Home and Farm Authority is subject to state taxes and to all state laws governing foreign corporations.

The suits filed by the ice manufacturers and the coal producers, although instituted separately, were identical in content. Also named as a defendent in the actions was the Alabama Power Company. The suits ask temporary injunctions to restrain the T.V.A., the E.H.F.A. and the utility from spending funds in the promotion of electric appliances and motors and also asks that the T.V.A. be restrained from constructing any additional hydro-electric plants.

Unfair competition alleged

Alleging that the authority program brings it into competition with the plaintiffs' ice and coal business, the complaints assert that 20,000 coal miners and thousands employed in the ice manufacturing industry would be thrown out of work, adding nearly 100,000 persons to relief rolls.

"The T.V.A. was created for the alleged purpose of operating Muscle Shoals properties of the United States in the interest of national defense and for agricultural and industrial development and for the improvement of navigation and flood control in the Tennessee Valley," said the petition.

"These objectives have in fact, from the outset, been supplemented by or are secondary to certain social and economic functions and purposes having no reasonable relation to the war or commerce power of the United States or Congress.

"The dominant motive of the plan, not authorized under the Federal Constitution, not charted by Congress and resting in the absolute discretion of T.V.A., is the generation and distribution of hydro-electric power to be intentionally developed beyond the maximum requirements for navigation, flood control or for war purposes, and the social planning and reconstruction of the valley area. The T.V.A. plan includes as an indispensable factor the acquisition of a market for excess energy produced. This acquisition is proposed both through competition with and displacement of existing business and industry in the area and through promotion of new or enlarged demand for energy, both means being beyond any legitimate federal power."

Carrying out of the plan, the petitions charged, would result in injury to ice, coal, gas utilities and all other industries with which T.V.A. proposes to compete. No date was set for hearing on the temporary or permanent injunction requests.

Meanwhile the appliance sales program of the E.H.F.A. continues, with sales of refrigerators ahead of shipments, according to a report made by T.V.A. Chairman Arthur Morgan to President Roosevelt this week. Electric ranges are in second place in the matter of sales, Mr. Morgan reported.

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Thayer Found Guilty by New York Senate

Despite the resignation of New York State Senator Warren T. Thayer last week, the Senate met this week in special session and by a unanimous vote of the 47 members present found Senator Thayer guilty of official misconduct. The charges grew out of revelations before the Federal Trade Commission in Washington of correspondence between the Senator and officials of the Associated Gas & Electric Company. Senator Thayer had been for several years chairman of the committee on public service of the Senate.

Following the decision in the Thayer case, the Legislature began preparations for the broad investigation into the public relations of the various utility companies in the state, their political activities and their participation in elections of local and state officials. The investigating committee, whose personnel is expected to be announced shortly, will be composed of four Senators and three Assemblymen.

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Cuban Strike Settled

Termination of the lengthy strike involving the employees of the Cuban Electric Company was settled finally, Havana reports indicate, when the company acceded to the 40 demands made by the striking employees.

Roosevelt Returns Code for Light and Power

Without explanation, President Roosevelt this week returned to the National Recovery Administration the electric light and power code, unsigned. After nearly a year of bitter discussion as to its provisions, the code was submitted to the President in drastically revised form early this month. It is understood that government agencies objected to the code as presently written because it is deemed unfavorable to publicly owned properties.

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Housing Measure Passes Congress

Last act of 73d Congress authorizes comprehensive plan of new home financing and mortgage insurance; sets up $200,000,000 home renovation program.

As its last legislative act before voting adjournment, the 73d Congress approved this week the administration's national housing act, designed to stimulate $1,500,000,000 in new home construction, home modernization and renovation. Business observers see in the measure an opportunity for the stagnant construction industries, and similarly a stimulus to the electrical contracting, manufacturing and light and power industries in the construction and renovation phases of the act.

Now before the President for signature, the act provides for a comprehensive program of home financing and mortgage insurance, and that financial institutions which make loans for financing alterations, repairs and improvements upon real property are to be insured up to 20 per cent of the total value of such loans, and also that loans may be made upon the security of obligations thus insured. Provision is made in the act for the appointment of a national housing administrator.

Mortgage insurance up to 80% of value

The program of mutual mortgage insurance provides that insurance of first mortgages on residential property which are amortized may be made up to $16,000 in any case and up to 80 per cent of the appraised value of the property.

Authorization is given for the establishment of national mortgage associations with authority to purchase and sell first mortgages and borrow money through the issue of securities up to ten times their outstanding capital or the current face value of the mortgages which they hold and which are insured under the act.

A corporation will be formed under the supervision of the Federal Home Loan Bank Board which will insure accounts of building and loan associations and similar institutions. The corporation will be required to insure accounts of federal sav-

ings and loan associations established under the authority of the home owners' loan act of 1933.

The measure limits to $200,000,000 the aggregate liability of the federal government in the home modernization and renovation aspects of the act. Funds for both renovation and mutual mortgage insurance are to be made available by the R.F.C. or from any funds available to the President for emergency purposes. The act further increased the Home Owners Loan Corporation's power to issue bonds to the extent of an additional $1,000,000,000, thus raising this power to a total of $3,000,000,000.

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James H. McGraw Celebrates 50th Publishing Anniversary

James H. McGraw, under whose guidance ELECTRICAL WORLD has been published since 1899, has just celebrated his 50th anniversary in business publishing. As chairman of the board of the McGraw-Hill Publishing Company, Inc., Mr. McGraw is still actively at work at 73 years of age and intensely interested, as he has always been, in the service of this paper to the electrical industry.

Mr. McGraw came down from Chautauqua County, New York, in 1884, a country schoolmaster, and with two friends began to publish a little paper called *Steam* (now *Power*), and a horse car paper, *Street Railway Journal* (now *Transit Journal*). In 1899 he combined two papers, *American Electrician* and *Electrical Engineer*, with ELECTRICAL WORLD and has continued to head the publication ever since. Today his company publishes 25 industrial, engineering and business papers. Mr. McGraw is a champion of private initiative in business and a stanch defender of the public utilities.

Speaking on his anniversary of the present business outlook, with the background of his half century of close contact with American industry, Mr. McGraw expressed strong confidence that this fall will see a returning flow of private capital into industry and business and distinct improvement in general conditions. He urged the leaders of business to unite in the support of the features of the government recovery program that are constructive and to oppose and correct those that are not.

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Bullet-Cut Power Lines Cause Boulder Dam Shutdown

Sharpshooters, whose bullets cut down power line cables between San Bernardino and Las Vegas, caused a four-hour shutdown on the Boulder Dam project last week. All operations were halted on the dam when the power failed. Huge buckets, carrying cement from the mixers to the dam, were stranded, and the concrete had hardened by the time operations were resumed. Six men on a cable-car suspended in midair 500 ft. above the floor of the canyon were marooned for four hours. Pumps draining the sump at the canyon's bottom were stopped and water approached to within twenty inches of the motors.

New River Case Carried to Court

Federal government asks that further construction be halted on the Hawks Nest project until license is obtained.

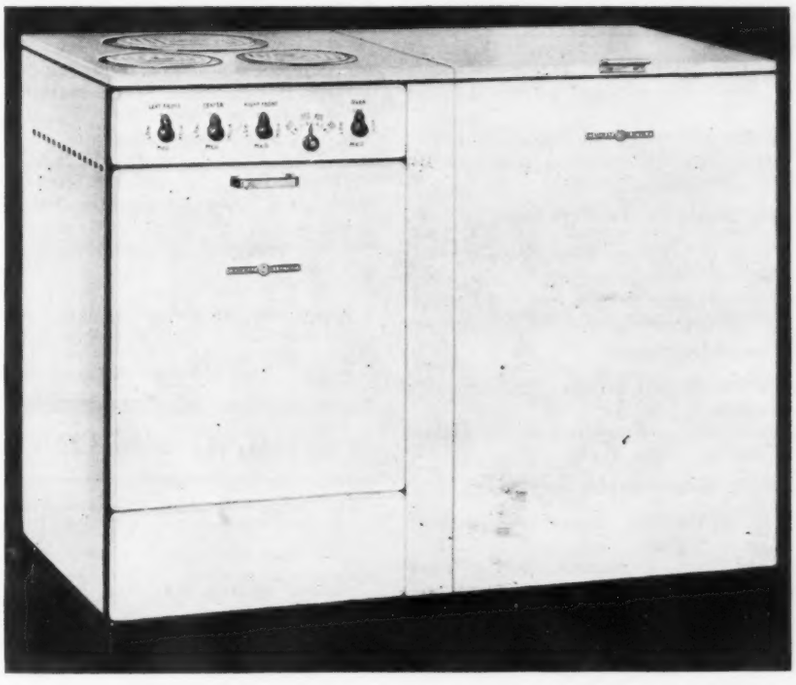
Another step was taken by the federal government to halt the Hawks Nest project on the New River, West Virginia, when the Department of Justice last week filed a bill in equity on behalf of the United States against the Union Carbide & Carbon Corporation and its subsidiaries, the Electro Metallurgical Company and the New-Kanawha Power Company, in the United States District Court at Charleston. The purpose of this action, taken at the request of the Federal Power Commission (ELECTRICAL WORLD, April 14, page 560), is to require the Electro Metallurgical Company to take out a license under the federal water power act to continue the construction and subsequent operation of a dam crossing New River near Hawks Nest and just above the place where New River changes its name to the Kanawha River.

For some time past, according to the bill, the Geological Survey has been recommending and the government has been purchasing thousands of acres on the upper reaches of New River, where it crosses the line from North Carolina into Virginia, for the purpose of reforestation, flood control and prevention of erosion that has filled up the channel of these two streams. As the New-Kanawha Rivers traverse three states, the government asserts that it is necessary that there shall be one control of the construction and operation of dams on these rivers.

Ask halt in construction, operation

The bill contends that the New and Kanawha Rivers are navigable waters within the definition of the federal water power act and that therefore the government should have control of all construction that interferes with or affects the flow of these streams. It asserts that the project constructed by the Electro Metallurgical Company, and about completed, at Hawks Nest will affect an interest in interstate commerce not only on New River but on the Kanawha River below, and that therefore the Electro Metallurgical Company should be required to take out a license. The bill asks that the defendants be enjoined from proceeding with further construction or operation of the project unless and until a license with the commission shall have been taken out. Huston Thompson, as special assistant to the Attorney-General, is in charge of the case.

G. E.'s Bid for the Mass Market



Born of T.V.A.'s insistence for low-priced electric appliances, this combination range and refrigerator, to sell for $139.50 at the factory, has been announced by the General Electric Company. The company's determination not to confine its sales of this product to the Tennessee Valley may open a new era of expansion in kitchen electrification. The units may be purchased separately or in combination; the range for $72, the refrigerator for $74.50. Although stripped of minor luxury-accessories, the range boasts automatic precision temperature control, and the all-steel refrigerator functions with the "monitor top" hermetically sealed compressor. Approved, the appliances will soon go on sale in the seven T.V.A. states, and will also be introduced nationally "in an aggressive manner," General Electric states.

Prizes Awarded Utility Advertising

Public Utility Advertising Association holds annual meeting and announces prize winners for advertising technique.

Prizes were awarded this week in the annual Better Copy Contest of the Public Utilities Advertising Association at its meeting on Tuesday, during the convention of the Advertising Federation of America in New York. This is the twelfth year in

NOW, BEFORE PRICES GO HIGHER,
Order A NEW DEAL for . . .
Your Home!
1 Cent
will . . .
Live Electrically
for a Few Cents a Day
Dallas Power & Light Company

The first prize winner in the electric newspaper advertising section

which the advertising of the public utility industries has been reviewed by a board of judges. The awards were:

Electric Newspaper Advertising—

First prize—Dallas Power & Light Company, Dallas.
Second Prize—Central Hudson Gas & Electric Corporation, Poughkeepsie.

Outdoor Advertising—

First Prize—San Antonio Public Service Company, San Antonio.
Second Prize—The New York Edison Company, New York.

Electric Window Display Advertising—

First Prize—The New York Edison Company, New York.
Second Prize—Tennessee Electric Power Company, Chattanooga.

General Utility Advertising—

First Prize—Northern States Power Company, Minneapolis.
Second Prize—Central Hudson Gas & Electric Corporation, Poughkeepsie.

Campaign Newspaper Advertising—

First Prize—Northern States Power Company, Minneapolis.
Second Prize—People's Gas Light & Coke Company, Chicago.

The day's program included a discussion of the best use of radio broadcasting by Miss Pattie Field of the National Broadcasting Company, commenting on the methods followed in Pittsburgh, Chicago, Cincinnati and Omaha by the local power companies. Floyd Parsons, editorial director of *Gas Age*, talked on "Building Public Confidence through Utility Advertising," and C. W. Spier of Batten, Barton, Durstine & Osborne made a strong plea for less forced dignity in utility advertising. Power companies, he said, should talk the "living language of the people" in every message directed to the public, if they expect a friendly human response. An appeal for broader participation in the coordinated poster advertising and a symposium on specific utility advertising problems concluded the day.

The following officers were elected for the coming year: President, Henry Obermeyer, Consolidated Gas Company, New York; first vice-president, J. R. Pershall, Public Service Company of Northern Illinois, Chicago; second vice-president, Donald Perry, Central Hudson Gas & Electric Company, Poughkeepsie; third vice-president, Kenneth Magers, Union Gas & Electric Company, Cincinnati; secretary, H. H. Olcutt, Jr., Philadelphia Gas Works, Philadelphia; treasurer, Howard F. Weeks, Consolidated Gas Company, New York.

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Kanawha River Hydros to Be Constructed

Construction of hydro-electric plants on the Great Kanawha River will be started soon, officials of the Appalachian Electric Power Company announced last week. Permission for construction of the plants, estimated to cost $4,000,000, has been obtained from the Federal Power Commission. The stations will be located at lock No. 2, Marmet, W. Va., which was completed in April; lock No. 3, at London, W. Va., to be finished July 1, and at the Winfield Dam upon its completion. Construction of the first two plants will involve dredging of approximately 334,000 cu.yd. of river bottom to provide for the forebay and tail race. A 24-ft. head will be available under normal conditions upon completion of the canalization project on that stream.

COMING MEETINGS

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

American Institute of Electrical Engineers — Summer convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

American Society for Testing Materials—Annual meeting, Atlantic City, N. J., June 25-29. C. L. Warwick, 260 South Broad St., Philadelphia, Pa.

National Electrical Credit Association—Annual meeting, Chicago, July 19-20. Frederick A. Lind, 1010 Marquette Bldg., Chicago.

Illuminating Engineering Society—Annual convention, Baltimore, Md., October 1-4. D. W. Atwater, secretary, 29 West 39th Street, New York.

International Association of Electrical Inspectors — Southern section annual meeting, New Orleans, La., October 1-4. Joseph Whitner, P.O. Box 1743, Atlanta, Ga.

. . . THIS WEEK IN WASHINGTON

President returns light and power code to NRA unsigned . . . Power Commission and P.W.A. objections said to be root of dissatisfaction . . . Nation zoned for power survey.

OBJECTIONS by government agencies, understood to have been the Federal Power Commission and the Public Works Administration, led President Roosevelt to return the electric light and power code to the National Recovery Administration without signature, as explained at the NRA. The code was returned with the comment of the other agencies so that NRA may express its views on the criticisms. The President admitted that he did not like certain provisions of the code, which he did not specify, but he did not state positively that he would not sign the code as submitted. It is assumed that the Federal Power Commission has objected to provisions which would permit the code authority to make general surveys of the industry. That agency believes that it is in a better position to make such surveys. The objection of the Public Works Administration is thought to be that the code is not favorable to publicly owned utilities and as a consequence would tend to impair the value of the security it has accepted for loans to publicly owned plants.

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Appointment of regional supervisors for the conduct of the general power survey to be undertaken by the Federal Power Commission will be announced in the near future. The country has been divided into eight zones and each zone will have a supervisor. Shortly after the announcement of the names of those who have been selected the supervisors will be called to Washington to receive the instructions necessary for the launching of this comprehensive survey.

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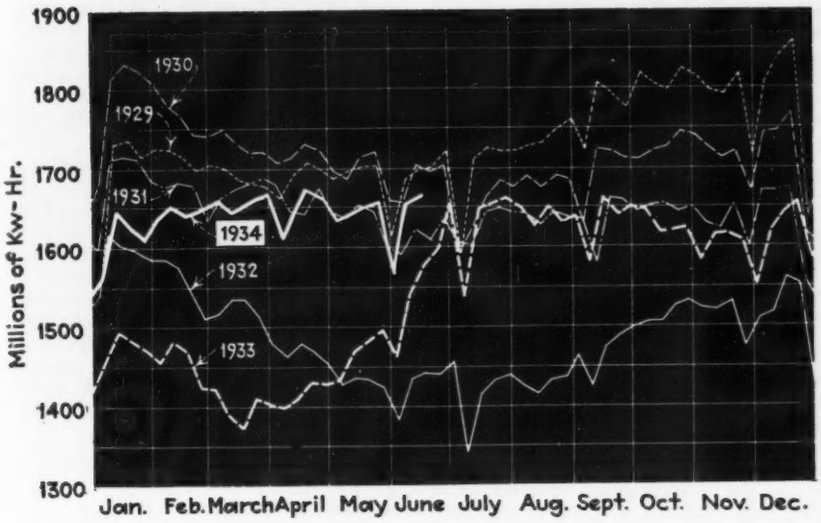
Had Congress adjourned June 16, as had been planned, congressional action would not have been completed on the joint resolution extending the utilities investigation of the Federal Trade Commission until January 1, 1936. By prolonging the session by another day an opportunity was given to pass the resolution in the House. It passed the Senate last week.

PAUL WOOTON,
Washington Correspondent.

Porcelain Makers Protest Lava Manufacturing Code

Contending that any materials used for electrical insulation are inherently in the electrical field, the electrical porcelain section of the National Electrical Manufacturers Association has registered protest with NRA Administrator Johnson on the grounds that the code is unduly extensive. The section asks to be heard at the public hearing to be held in connection with the proposed lava code, asserting that manufacture of such lava material as is used in the electrical field is a part of the electrical manufacturing industry and as such should be governed exclusively by the Electrical Manufacturing Industry code.

Output Nears Year's Record



Continuing close to the figures for the best years, electrical energy output during the week ended June 16 advanced to 1,665,358,000 kw.-hr., according to the Edison Electric Institute. This is the second consecutive rise at a time when the annual low point is normally to be expected. Instead, it brings the output within a fraction of 1 per cent of the 1934 record thus far, set in the week of April 21. Production in the next highest week (April 28) was virtually equaled, that of March 31 was tied, and that of the corresponding week of 1929 was missed by only 2 per cent. The excess over a year ago, when an unprecedented rise was in progress, has dropped to 5.5 per cent.

The only striking regional change was the disappearance, in the Rocky Mountain area, of recent high percentages. New England, where the gains a year ago were exceptional, is again 2 per cent under 1933.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
June 16...1,665	June 17...1,578	June 18...1,442
June 9...1,655	June 10...1,542	June 11...1,435
June 2...1,576	June 3...1,461	June 4...1,381
May 26...1,655	May 27...1,494	May 28...1,425
May 19...1,650	May 20...1,483	May 21...1,436

Per Cent Change from Previous Year

Region	Week ended June 16	Week ended June 9	Week ended June 2
New England	— 2.1	— 2.2	+ 1.9
Middle Atlantic	+ 5.7	+ 7.0	+ 5.6
Central Industrial	+ 7.3	+10.3	+10.9
West Central	+11.7	+12.6	+14.0
Southern States	+ 5.2	+ 4.5	+ 3.2
Rocky Mountain	— 0.7	+12.5	+23.5
Pacific Coast	+ 7.4	+ 8.6	+10.2
United States	+ 5.5	+ 7.3	+ 7.8

Brooklyn Rapid Transit Gets Multi-Section Cars

Two light-weight, high-speed, multi-section cars have been built for trial operation on the "L" lines and local subway lines of the Brooklyn-Manhattan Transit Corporation. One built by the Pullman Car & Manufacturing Corporation of aluminum furnished by the Aluminum Company of America and equipped with motor, control and brake apparatus developed by the Westinghouse companies has already been delivered. The other, constructed of stainless steel by the E. G. Budd Manufacturing Company and equipped with motor, control, door and brake apparatus developed by the General Electric Company, will soon be delivered for operation. The cars are the culmination of the efforts since 1927 of the New York Transit Commission to help develop all-metal faster equipment that could be used on the present "L" structures. The commission approved their construction a year ago.

The cars are built in five sections, with circular vestibules connecting them and mounted on six trucks. Their maximum weight (167,800 lb.) is less per axle than that of the present elevated equipment and the weight per square foot of floor area, loaded, is but three-fourths that of present equipment. Two 70-hp. motors per truck operating at 300 volts, two-in-series, and driving the axles through double-gear reduction, permit a maximum acceleration of 4 m.p.h.p.s., with normal seated load of 186 passengers, and three when carrying a rush-hour load. Braking is combined dynamic and electropneumatic, with straight air back up or emergency braking. Faster acceleration, a top speed of 53 m.p.h. and quicker brake action, both in application and release, permit increase in schedules of 40 per cent on the lines on which the first will be placed in operation next week.

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Tin-Lead French Battery

A new type of storage battery in which a plate of tin is used as the negative with the usual lead plate as the positive was shown at the recent exhibition in Paris of the Société Française de Physique by C. Fery, secondary battery expert. To prevent any movement of the electrolyte it is mixed with a granulated porous material of a silica character, which is unaffected by sulphuric acid. When the battery is in use small non-cohering crystals are deposited from the negative tin plate and while being recharged the tin is redeposited on the plate. The redeposited tin has only a slight degree of adherence to the plate and is held in position to some extent by the porous metal used in conjunction with the electrolyte.

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Electrical Output in Italy Increases

According to statistics just published by the "Unfiel" (Unione Nazionale Fascista Industrie Elettriche), the output of electricity in Italy, during the first two months of 1934, amounted to 1,793,621,000 kw.-hr. against 1,664,982,000 kw.-hr. during the corresponding period of 1933. While the output of steam plants decreased from 51,811,000 kw.-hr. during January and February, 1933, to 48,699,000 kw.-hr. during the corresponding period of 1934, the output of hydro-electric plants increased from 1,613,171,000 kw.-hr. to 1,744,922,000 kw.-hr. Plant capacity remained unchanged. For the same period the consumption for lighting increased from 159,000,000 kw.-hr. to 161,000,000 kw.-hr. The increase, though small, seems to show an improvement in the economic condition of the country.

Factors favorable to the electrical manufacturing industry are the decision of several companies owning secondary railways to electrify, the proposed reorganization of electric tramway service in Genoa and Naples and projects now being studied to build a new electric railway out from Milan to be known as Ferrovia Electrica Sud Milano.

Though the decrease of orders from Soviet Russia, which practically ceased during 1934, seriously affected the manufacture of electrical machinery, noteworthy orders for mercury-vapor rectifiers, electric pumping plants, etc., have been assured by the electrification of the State Railways and the reclamation work carried on by the government.

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More Efficient Lamps to Be Made in Britain

More efficient incandescent lamps of the type now in use on the Continent (ELECTRICAL WORLD, April 7, 1934, page 525) will be introduced in the 40-watt size this fall by the British associated electric bulb manufacturers. Photometer tests show that they give 20 per cent more light for the same energy than the present British types of incandescent bulbs. The design is termed the "coiled coil" design, for its higher efficiency is achieved by coiling the filament upon itself. The thickness of the filament wire is only a few ten-thousandths of an inch, and the first coiling is on a mandril little more than double the diameter of the wire, with the turns accurately spaced at five ten-thousandths of an inch.

As to Rates . . .

Arkansas Power & Light Company last week announced reductions in rates to more than 200 cities and towns served by the company in Arkansas. The cut is estimated to save consumers around $225,000 a year. The reduction will become effective with July meter readings. New residential rates will be 6 cents for the first 40 kw.-hr., 5 cents for the next 110 kw.-hr., 3 cents for the next 150 kw.-hr. and 3 cents for all in excess of 300 kw.-hr. The reduction in each block is 1 cent. The new commercial rates will be: 6 cents for the first 300 kw.-hr., as compared with the old rate of 7 cents for the first 500 kw.-hr.; 5 cents for the next 700 kw.-hr., as compared with 6 cents for the next 500 kw.-hr.; 3 cents for the next 1,000 kw.-hr., as compared with the old rate of 2½ cents for 1,500 or more kilowatt-hours, and 2 cents for all over 2,000 kw.-hr.

Federal Public Service Corporation's rates in six West Virginia towns have been ordered reduced by the state Public Service Commission. The towns affected are Hubball, West Hamlin, Branchland, Yawkey, Hamlin and Griffithsville. The new rates, effective after June meter readings, are: 10 cents per kilowatt-hour for the first 25 kw.-hr., 6 cents for the next 25 kw.-hr. and 3½ cents for all over 50 kw.-hr.

Florida Power & Light Company, following its offer to reduce rates in the city of Miami two weeks ago, last week announced rate reductions affecting 149 Florida communities, excluding Miami. The greatest reduction is in the lighting rate and allows small lighting customers to use as much as 25 per cent more energy without increasing their bills. A new one-meter rate for small houses and apartments for customers using lighting and one major appliance has a low block of 3 cents a kilowatt-hour. The former flat rate in the original one-meter rate for large residential consumers now includes 30 kw.-hr. and the low block remains at 2 cents a kilowatt-hour. A number of the cities and towns now under contract for street lighting have been offered a 50 per cent increase in lights at no increase in total cost. Cuts were also made for municipal water pumping and sewage disposal plants.

Nebraska State Railway Commission has again ruled that it has jurisdiction to fix rural electric rates in that state. The case was brought by patrons of the Iowa-Nebraska Light & Power Company, who challenge the legality of the company's actions in raising kilowatt charges on the first rate group sufficient to absorb the service charge made before the Legislature banned its making. An appeal was promptly taken to the state Supreme Court. The proceeding was agreed upon in order that the state courts may pass on the question. In the previous case the Southern Nebraska Power Company went into the federal courts, challenging both jurisdiction and compensatory character of the rates fixed. As a federal court is governed by state court decisions on state matters, its decision on jurisdiction was felt by both commissioners and Iowa-Nebraska Power Company attorneys to be inconclusive, since the state courts might later take the opposite position. For this reason a direct appeal to the Supreme Court was agreed upon.

Public Service Company of Indiana has accepted without further litigation an order of the state Public Service Commission issued June 9 reducing electric rates in 299 communities served by the company. The cut will result in an annual saving of approximately $800,000 to consumers. Efforts of the company will be directed at increasing the use of electricity under the lower rates in an attempt to regain the revenue lost through the commission order. John N. Shannahan, president, said: "Although the company had the alternative of appealing the commission's decision and submitting evidence to the court to support our contention that operating expenses have increased substantially, it was decided that a thorough trial should be given the new rates. . . ."

Gloucester Electric Company has been ordered by the Massachusetts Department of Public Utilities to reduce its rates. It is estimated that the new yearly residential rates will reduce income of the company $11,200 a year, one-half of this amount being the reduction for 1934. The new commercial rates will show a reduction of $5,000 a year. The commission states that these figures are based on the supposition that the company will do as much business in 1934 as it did in 1933. For a full year the new schedules will reduce the income of the company by $20,950, and in 1934 the total reduction will be $12,850.

Cleveland Electric Illuminating Company has been asked by Mayor Harry L. Davis to grant a reduction in its street lighting rate and to rescind a stipulation that it will grant the city a 6 per cent discount on a proposed new rate only if street light bills are paid on time. In a formal bid for five-year renewal of its street lighting contract the company offered a rate cut of 9.76 per cent, but on the condition that bills be paid monthly and that the 7,000 lights serviced by the company be illuminated. The city has not been able to pay for street lighting for nearly a year, and two months ago turned off part of the lights for which the company furnishes current.

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Blue Springs Suit Tests Bond Limitations

The Missouri Supreme Court at Jefferson City, Mo., has taken under advisement the suit brought by the Mayor and other city officials of Blue Springs to test the validity of Missouri cities and towns of less than 75,000 issuing revenue bonds for public utility works to be paid out of plant earnings, without a vote of the people. The city has applied for a P.W.A. grant of $24,000 and loan of $80,000. Argument on the mandamus proceedings to compel the city clerk and treasurer to issue $80,000 of such bonds authorized by the City Council for the construction of a municipal water distribution system and to deliver them as collateral for the P.W.A. grant and loan was heard by the Supreme Court on May 24.

A number of private utilities in the state opposed the suit because of the state-wide effect it would have should it succeed. The opponents contend that present state laws requiring a two-thirds favorable majority vote of the people before such bonds can be issued and placing limitations on the total debts a city can legally contract would be scrapped if the Blue Springs suit prevails. The city attorneys hold that the bonds are not covered by these limitations.

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Court Overrules Utility in Municipal Plant Suit

Motion for a new trial filed by the Public Service Company of Indiana in its suit for an injunction against the electric utility operated by the city of Newcastle has been overruled by Judge John Craig of Newcastle Circuit Court. The utility company seeks to enjoin the city from extending its service to private consumers. Immediate action was started to appeal Judge Craig's decision to the state supreme court. The company contended the court's denial of the injunction was not supported by the evidence.

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Middlesboro Lights Off as City Bills Are Unpaid

Cut-off of all municipal electric service in Middlesboro, Ky., was effected by the Kentucky Utilities Company after failure of the city to pay in full the amount due for services up to February 17. Streets and public buildings are without light, but residential and commercial services were not affected. A recent Court of Appeals decision ruled the company had a right to discontinue services to the city on or after June 1, in view of the failure of the city to pay the total due of $35,000, or to make a satisfactory settlement. The city claims it is entitled to a discount and is awaiting a court ruling on the amount due. A P.W.A. loan and grant of $328,000 to build a municipal light and power plant is being held up pending a referendum on the question.

The city lost its appeal to the Court of Appeals from judgment of the Bell Circuit Court in favor of Henry R. Giles, who sued to prevent the city from holding a referendum election June 15 on the question of borrowing federal funds to build a municipal power plant. A city ordinance called an election June 15 on the question of whether the loan should be sought. Mr. Giles attacked the validity of the ordinance, contending that city officials had no right to order a special election. The lower court refused to sustain the city's demurrer.

FINANCIAL · · · BUSINESS

Weighted Index Valuation Refused as Court Evidence

Rate making appraisals based on adjusted values determined by the use of weighted index numbers of commodity prices have been refused as evidence by the Maryland United States District Court. In an appeal to the court by the Chesapeake & Potomac Telephone Company of Baltimore against a rate decision of the Maryland Public Service Commission, the court held that it could not accept as evidence of the present fair value of the property the Commission appraisal attained by adjusting a previous accepted fair value "to reflect current price levels and trends by the use of certain weighted index numbers of commodity prices, where such prices were based upon a different and more fluctuating character of property than that actually inherent in the utility plant under inquiry." The court also held that a rate order leaving a return of 4½ per cent on a telephone company's property was confiscatory, and expressed the opinion that a return of 6 per cent would be required.

Commonwealth & Southern Shift Brings Operating Heads to Board

Wendell L. Willkie becomes chief executive officer as B. C. Cobb resigns. Board reorganization made to centralize operating functions, Willkie says. Groesbeck, Loomis, Stevens and Thorne resign

In a move calculated to unify more completely the operation and functions of its operating companies, the heads of six of Commonwealth & Southern Corporation's larger operating units were elected this week to the corporation's board of directors. The reorganization in the management of the holding company included the retirement of B. C. Cobb as chairman and director and the resignation of four other

W. L. Willkie

directors, C. E. Groesbeck, A. L. Loomis, Ray P. Stevens and Landon K. Thorne.

Wendell L. Willkie, president of the company, now becomes chief executive officer. Mr. Cobb's resignation had been expected for some time, as an operation he had undergone last summer had led to a cessation of his business activities early this year.

The new directors

The new members of the board of directors are: Preston S. Arkwright, president Georgia Power Company; A. C. Blinn, general manager Ohio Edison Company; Jo Conn Guild, Jr., president Tennessee Electric Power Company; D. E. Karn, general manager Consumers Power Company, and R. S. Wallace, president Central Illinois Light Company. Thomas W. Martin, president of the Alabama Power Company, was re-elected to the board.

President of the corporation since January, 1933, Mr. Willkie has been a leading figure in negotiations with the Tennessee Valley Authority which resulted in effecting agreements between the company and the authority determining territorial divisions, power interchange and general co-operation in the T.V.A.'s program.

In a formal announcement after the meeting Mr. Willkie said: "The election to the board of the chief operating executives of the six larger operating units of the Commonwealth & Southern System is another step in the established policy of the Commonwealth Corporation to unify more completely its functions and operations.

"State laws and the absence of a federal incorporation act make holding companies necessary and now prevent the operation of all units under one corporate charter. However, by close co-operation between the executives of the respective operating units, the practical effect is to make the system one large operating unit.

"Some time ago intermediate holding companies were eliminated and the supervision of the operating units was transferred to a servicing company, the stock of which is owned by the operating companies."

Mr. Cobb, the retiring chairman, has been identified with the management of public utility properties since 1895. For 23 years he was connected with Hodenpyl, Hardy & Company, Inc., and when that company was consolidated in 1928 with Stevens & Wood interests, to form the Allied Power & Light Corporation, he was serving as a vice-president and as an operating official of many of its subsidiaries. When Commonwealth & Southern was organized in 1929 Mr. Cobb became chairman.

Mr. Willkie has been a director and officer of Commonwealth & Southern and certain of its subsidiaries since 1932. In 1929 he became associated with Judge John C. Weadock in the firm of Weadock & Willkie, general counsel for the Commonwealth corporation, and has been active in the company's affairs since that time. Following graduation from law school he became a member of Mather, Nesbitt & Willkie of Akron, Ohio, and as such represented some of the most important utility, railroad, banking and industrial interests.

In addition to Mr. Willkie and the chief executives of the six operating subsidiaries, the directorate of Commonwealth & Southern comprises W. H. Barthold, S. Sloan Colt, Jacob Hekma, George Howard, T. A. Kenney and E. A. Yates of New York, C. M. Clark of Philadelphia and W. H. Hassinger of Birmingham, Ala.

RESISTANCE

Apparently to confound those doubting souls who anticipate a midsummer slump, perhaps sharpened by prolonged labor difficulties, major indicators of current business volumes demonstrate sustained strength. Energy production almost reaches to its high point for the year. Automobile production, probably due to lower prices, improved. Carloadings increased appreciably. Bituminous coal production likewise maintained its upward trend. Steel mill activity, although declining slightly, remains at a high level. Commodity prices improved, and securities show definite, if unspectacular, gains.

With congressional adjournment finally realized, there comes an end, for the time, of the fear of additional business-restricting legislation. What course the Administration will take, with the broad discretionary powers invested in it by the legislators, now becomes the question of the moment. Executive action upon the amazingly deflationary farm bankruptcy act offers an interesting development.

Utility Coal Contracts to Be Investigated

New coal contracts between the Peabody Coal Company and Commonwealth Edison Company, Public Service Company of Northern Illinois and Super-Power Company of Illinois have been filed for Illinois Commerce Commission approval as a result of the authority conferred on that body to pass upon all supply, management, service and other contracts with affiliated interests by the amendments to the public utilities act enacted last year.

In passing upon the contracts the commission asserts it will make a full and complete inquiry into every relevant fact entering into the price for coal and will expect the utilities concerned to show that the contracts are in the public interest.

Only Four Utilities Offer Securities in Five Months

Only $38,667,237 in effective securities registrations were made by electric light, power, gas and water companies during the first five months of 1934, the Federal Trade Commission announced this week. The total issues, excluding reorganization securities, were made by four companies and represent 12.9 per cent of the total gross proceeds of 179 registrations effective during the five-month period.

The total gross proceeds for all industries, for the 179 registrations, excluding reorganization securities, was $229,954,055 for the January-May period. Issues of financial and investment companies account for $180,508,470, or 60.2 per cent of the total, while 58 registrations of manufacturing industries aggregate $48,000,982, or 16 per cent of the total.

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Gary Electric Plan Revised for Bondholder Protection

"More effective protection" for depositing bondholders of the Gary Electric & Gas Company is the reason announced by Chairman John N. Shannahan for the change this week in the plan of extension of first lien collateral 5 per cent bonds due on July 1. Under the amendments to the plan the $100,000 annual sinking fund has been made cumulative and the balance of any "remaining net income" required to be set aside in the sinking fund has been increased from 25 to 50 per cent.

More adequate representation on the board in the event of default and the setting aside in the sinking fund of all liquidating dividends from the sale of property and interest and principal payments received by the company are other changes appearing in the new plan.

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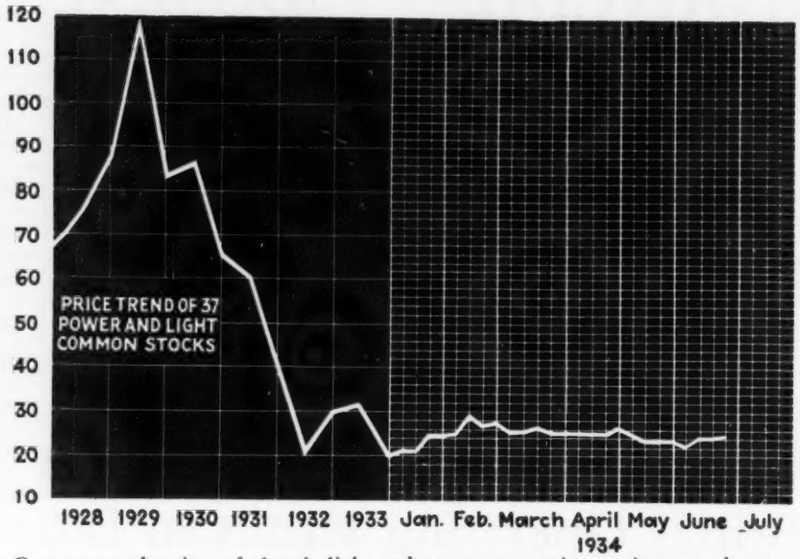
Dividend Accumulations Reduced by Utilities

Several utility companies which have been in arrears in dividend payments have announced that accumulations will soon be reduced. Missouri Edison Company declared a dividend of 58⅓ cents a share on the 7 per cent preferred stock, payable on account of accumulations July 2 to stockholders of record June 20. Following this payment arrears will be $4.66⅔ a share.

Ohio Electric Power Company has declared accumulation payments of $1.75 a share on the 7 per cent preferred and $1.50 on the 6 per cent preferred, payable July 2 to stockholders of record June 20. Effective with these payments arrears will be $5.25 and $4.50 respectively.

Southwestern Light & Power Company has also declared a dividend of 50 cents a share on account of accumulations on the 6 per cent preferred stock, payable July 2 to stockholders of record June 15, following which arrears will be $4.75.

Utility Stocks Advance Further



Common stock prices of electric light and power companies continue to advance. *Electrical World* index rose from 24.5 last week to 24.9, the highest point recorded since the end of April.

Central States Utilities Bond Default Expected

Default in the interest due on July 1 on its ten-year 6 per cent secured bonds apparently is inevitable, D. H. Bender, vice-president of the Central States Utilities Corporation, has advised holders of the securities. Further advances from the parent company, Utilities Power & Light Corporation, could not be expected, Mr. Bender said. Explaining that normally the parent company is dependent upon the receipt of dividends from Central States Power & Light for its bond interest, Mr. Bender stated that no dividends had been received from that source since June 30, 1931. Central States interest payments were made possible by assistance rendered by the parent company through January 1, 1934.

A plan of exchange to avoid default has been offered to holders of the bonds, of which 3,500,000 are outstanding. The plan is outlined on the basis of $1,400,000 of the amortized amount of $6,000,000 5 per cent debentures, due in 1944, of Central States Power & Light Corporation, or 40 per cent in debentures for 100 per cent of the bonds.

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General Electric, Ltd., Shows Decline in Profit

Showing a £36,667 decline in net earnings compared with the previous year, the report of General Electric Company, Ltd., for the fiscal year ended March 31, 1934, shows net profit of £534,485 after debenture interest, depreciation, directors' fees and pension fund. This compares with £571,152 in the preceding year.

After payment of £252,000 preference and £180,291 common dividends and appropriation of £100,000 to reserves there remained a balance for the year of £2,194, which, with £421,245 brought forward from the previous year, made a total of £423,439 carried forward to surplus.

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Refrigerators, Motors Show Large Export Gains

Export gains of 50 per cent or more in the first quarter of 1934, as compared with the low point in the same period a year ago, were made by commercial and domestic electric refrigerators and electric motors. According to an announcement of the Chamber of Commerce of the United States, showing that 40 leading American export commodities registered quantity gains of 50 per cent or more in the first quarter, the gains were: Commercial electric refrigerators, 371 per cent; electric motors, 209 per cent; household electric refrigerators, 179 per cent.

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New York Firm Low Bidder for Grand Coulee Dam Job

With its bid more than $5,000,000 under that of its only acceptable competitor, Silas H. Mason, Inc., of New York was low bidder at $29,339,301.50 for construction of the Grand Coulee Dam on the Columbia River. The only other acceptable bid was that of Six Companies of Washington, Inc., an affiliate of Six Companies, Inc., builder of the Boulder Dam. This bid was for $34,555,582.

Contract for the construction will be let by the United States Reclamation Service after checking the bids. Specifications under the present contract call

for the diversion of the Columbia River and construction of the dam and power plant, but do not include installation of power plant equipment and machinery. This last will be under a separate contract.

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Westinghouse Receives Large Steel Mill Order

What company officials assert is the largest single order for steel mill electrical equipment since 1929 was received last week by the Westinghouse Electric & Manufacturing Company. Ordered for a 76-in. strip mill now being built by the Mesta Machine Company, the order includes motors, control material, motor-generator sets and auxiliary units. The mill when completed will be used by the Youngstown Sheet & Tube Company. Included in the order are six 3,500-hp. motors.

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Government Cancels Bidding for Bonneville Equipment

Previous invitation for bids on turbines and governors for the Bonneville Dam project have been canceled, the United States Engineers office at Portland, Ore., announced last week. Revised specifications and invitations for bids will be issued shortly, the announcement reveals.

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Ajax Sells Navy Furnace

For the production of steel castings at the Navy Yard at Washington the Ajax Electrothermic Corporation of Trenton has sold a 300-kw. Ajax-Northrup melting furnace. Four furnaces will now be available at the yard for alternate operation, two of 2,200 lb., one of 250 lb. and one of 100 lb. capacity.

•

Gilby Wire Has Dividend

Its first distribution to stockholders in three years, the Gilby Wire Company, Newark, N. J., disbursed dividends of 10 cents per share on the no-par common stock on June 15. Wilbur B. Driver, president, states that the company is operating at a profit, despite increased costs due to NRA, and the fact that selling prices have not advanced. The company is now arranging to incorporate its business in France as a separate French company under the name of Gilby Wire Company Société Anonymé.

New York Metal Prices

	June 12, 1934 Cents per Pound	June 19, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.90	7.85
Nickel ingot	35.00	35.00
Zinc, spot	4.60	4.55
Tin Straits	51.50	50.25
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Brooklyn, N. Y. — Board of Transportation, New York, N. Y., asks bids until July 9 for complete signaling and switching equipment, with accessories, for new subway lines on Fulton and other streets.

Harrison, N. J. — Reynolds Metals Company, New York, N. Y., plans installation of motors, controls, regulators, conveyors and other equipment in new tin foil plant at Harrison, where former group of eight multi-story factory units of Edison Lamp Works has been purchased. Cost over $125,000.

Bend, Ore. — Plans new ornamental street-lighting system in business district. Estimate of cost will soon be made.

Isleton, Calif.—Golden State Cannery plans installation of motors and controls, conveyors and other equipment for rebuilding of portion of plant, recently destroyed by fire. Loss over $100,000.

Indianapolis, Ind.—Indiana Breweries, Inc., plans extensions and improvements, with installation of new equipment. Cost over $80,000.

Schoodic Peninsula, Me. — National Park Service, Department of Interior, Washington, D. C., asks bids until June 26 for construction of electric distribution line from Frazer Creek to power substation at Naval Radio Station, Schoodic Peninsula, Hancock County.

South River, N. J. — American Enameled Brick Corporation plans installation of motors and controls, conveyors and other equipment in connection with rebuilding of plant, completely destroyed by fire recently. Loss about $500,000.

Spearman, Tex. — Plans new city-owned electric light and power plant. Fund of $90,000 is being arranged.

Dayton, Ohio—Inland Manufacturing Company, subsidiary of General Motors Corporation, Detroit, Mich., plans installation of motors and controls, conveyors and other equipment in new addition to automobile equipment manufacturing plant. Cost about $300,000.

Jackson, Mich. — Consumers Power Company, Jackson, contemplates extensions in transmission lines for connection with system of Lower Peninsula Power Company at Frankfort, Plainwell and vicinity, recently acquired and to be consolidated with properties of purchasing company.

Auburn, N. Y.—Is completing plans for new city-owned electric light and power plant, distributing and street-lighting system. Diesel engine-generator units will be used. Fund of $310,000 has been secured through federal aid.

Albuquerque, N. M.—Supervising Engineer, Indian Irrigation Service, Albuquerque, asks bids until July 2 for hydraulic turbine, governor and accessory equipment, and electric generator, exciter, switchboard, instruments and auxiliary equipment for Mescalero generating station.

Newark, N. J.—Breeze Corporations plan installation of motors and controls, regulators, conveyors, pumping machinery and other equipment in new aircraft equipment manufacturing plant at Newark Airport. Cost over $250,000.

Knoxville, Tenn.—Tennessee Valley Authority plans early construction of four new power dams in connection with hydroelectric power development on Clinch River and other points in Tennessee Valley district. Fund of $48,000,000 is being arranged for immediate work noted. Bids will be asked.

Pittsburgh, Pa.—Plans installation of motors and controls, conveyors, loaders, furnaces, stokers and other equipment in two new city-owned incinerator plants. Cost about $1,000,000.

New Bern, N. C.—City plans extensions in distributing lines for commercial lighting to Tuscarora, Fort Barnwell and vicinity, about 10 miles.

Terre Haute, Ind.—Merchants Distillery plans extensions and improvements, with installation of new equipment. Cost about $70,000.

Sayre, Pa.—Sayre Electric Company, operated by Northern Pennsylvania Power Company, Binghamton, N. Y., plans rebuilding of portion of power substation, recently damaged by fire.

Detroit, Mich.—Midland Steel Products Company, Cleveland, Ohio, plans installation of heavy-duty motors and controls, conveyors and other equipment in new automobile equipment manufacturing plant on site recently acquired on Mount Elliott Avenue, Detroit. Cost over $150,000.

Oroville, Wash. — Custodian, United States Inspection Station, asks bids until June 29 for floodlighting system for local station.

Mendenhall, Miss. — City asks bids until July 3 for transformers and accessory equipment.

Huntington Beach, Cal.—O. C. Field Gasoline Company plans installation of air compressors, motors and controls, pumping machinery and other equipment in connection with rebuilding of gasoline refining plant, recently destroyed by fire. Loss over $150,000.

Marion, Ind.—Construction Service, Veterans' Administration, Washington, D. C., asks bids until June 29 for street-lighting system at institution at Marion.

Warren, Ohio—American Welding & Manufacturing Company plans installation of motors and controls, conveyors, etc., for rebuilding of portion of plant, recently destroyed by fire. Loss about $50,000.

Coolidge, Ariz. — United States Indian Irrigation Service, Los Angeles, Calif., has awarded contract to Quality Electric Company, Los Angeles, for construction of new 80-mile transmission line at Coolidge, at $42,247. (Project No. F.P. 261.)

MEN OF THE INDUSTRY

W. L. Hinds Elected to Niagara Hudson Board

William L. Hinds and Harry S. Lewis were elected last week to the directorate of the Niagara Hudson Power Corporation. They succeed Landon K. Thorne and George Roberts, who have resigned. Mr. Hinds is vice-president of the Crouse-Hinds Company of Syracuse, manufacturer of electrical supplies, and is also a director of several up-state banks and manufacturing companies. Mr. Lewis is president of the J. P. Lewis Company of Beaver Falls, N. Y. Their election places two up-state business men, in territory served by the utility, on the company's board.

Mr. Roberts had been a director of the company since its formation in June, 1929, under the ægis of J. P. Morgan & Company, Bonbright & Company, F. L. Carlisle & Company and the Schoellkopf interests. Mr. Thorne became a representative of the Bonbright interests on the company's board following the resignation of R. P. Stevens, who was a director and first president of Niagara Hudson Power. Both Mr. Thorne and Mr. Roberts resigned recently from Bonbright & Company.

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John Morse of Montreal was elected president of the Canadian Electrical Association for the coming year at the close of the recent three-day meeting.

George C. Gardner has been appointed district manager of the Louis Allis Company with headquarters in Atlanta, Ga. The territory served from this office includes the states of North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee and Mississippi. Mr. Gardner has been identified with the electric motor industry in Atlanta and other sections of the South for many years.

A. P. Bronson has been appointed resident manager of the office recently opened by the American Sheet & Tin Plate Company in Milwaukee, Wis. Mr. Bronson is assistant manager of sales for the company. **W. P. Andrews** has been appointed assistant manager of sales in the Chicago office.

Hugh A. Warner has been appointed lighting specialist for the Electric Home and Farm Authority. His first efforts to develop better lighting among industrial, commercial and residential consumers will be concentrated in Tupelo, Miss. Graduating from Georgia Institute of Technology in 1910, Mr. Warner saw service in the navy's steam engineering school, and has had a varied experience with manufacturers and power companies in Georgia, North and South Carolina, Florida, Alabama, Mississippi, Louisiana and Tennessee. He has served as a consultant in industrial, commercial, street and airport lighting, and in all forms of interior, utility and decorative illumination.

E. C. Gainsborg has been appointed general manager of the Roller Bearing Company of America, Trenton, N. J. Mr. Gainsborg for several years was sales manager for that company.

Sir Hugo Hirst, founder and chairman of the General Electric Company, Ltd., was honored this month when the honors list issued on the occasion of the sixty-ninth anniversary of the birth of King George announced Sir Hugo's elevation to the barony.

Dr. Irving Langmuir, associate director of the General Electric research laboratory, received on June 11 an honorary degree as doctor of laws from Union College, Schenectady. Dr. Langmuir delivered the principal address at the commencemnt exercises, his subject being "Science as a Guide in Life."

Charles E. Fletcher, for many years superintendent of distribution of the Sierra Pacific Power Company, Reno, Nev., has been appointed general superintendent, succeeding E. D. Brown. Mr. Fletcher has been connected with the company in various capacities since 1916.

Guy T. Shoemaker has been named assistant general manager of the United Light & Power Company, Davenport, Iowa, properties. Mr. Shoemaker will also continue his duties as vice-president of the United Light & Power Engineering & Construction Company, a subsidiary, as well as the post of electrical and mechanical engineer in chief.

E. Arthur Baldwin, a vice-president of the International General Electric Company, Inc., has been designated by the American government as an official observer to the eighteenth session of the International Labor Conference, which is now in session at Geneva.

Dana M. Wood, formerly hydraulic engineer of the Stone & Webster Engineering Corporation and more recently consulting engineer with offices at Boston, Mass., has been appointed senior hydraulic engineer of the Tennessee Valley Authority, effective July 2. He will have charge of stream flow and water power investigations and will make his headquarters at Knoxville, Tenn.

D. A. Nemser has been appointed development engineer of the International Nickel Company, Inc., with headquarters in Hartford, Conn. Mr. Nemser was for ten years associated with the metallurgical staff of Pratt & Whitney Manufacturing Company, Hartford, Conn., occupying the position of chief metallurgist for the past five years. In his new capacity Mr. Nemser will work with manufacturers throughout the New England territory on problems involving the selection, heat treatment and utilization of nickel alloy steels, nickel cast irons and other alloys containing nickel.

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Emerson Electric Announces New Executive Officers

With the accession of **Joseph Newman** to the presidency of the Emerson Electric Manufacturing Company last fall, **H. I. Finch,** formerly president, became chairman of the board. The recent resignation of H. S. Gilliam, treasurer, and E. L. Barkhouse, long vice-president in charge of sales, results in further shifting of responsibilities and functions. Mr. Newman has assumed the duties of treasurer as well as those of president. Succeeding Mr. Barkhouse, **Milton C. Miller** becomes vice-president, with the entire sales department as his immediate domain, but with other executive duties included in the scope of his activities. Mr. Miller joined Emerson Electric early this year, having been for six years previously connected with the Lyon Metal Products Company, Aurora, Ill., in a sales executive capacity.

The new manager of motor sales is **L. F. Blough,** who, like Mr. Miller, joined the company after a connection with the Lyon Metal Products Company, where he had been for several years manager of the agency division. **Herbert L. Parker, Jr.,** continues as secretary under the new régime and will also continue to be executive of the heating and ventilating division. **Frank A. Gooding** continues as manager of fan sales. **O. C. Schmitt,** also an Emerson veteran in every sales department and for the past four years advertising manager, has been promoted to the position of sales promotion manager, the advertising department now being but one of his responsibilities. **T. J. Egan** and **O. D. Metz** remain in charge of the Chicago and New York offices respectively.

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Paul E. Carlson has been appointed sales manager of the Lawton Engineering Corporation, Boston, Mass., New England headquarters for the General Electric Company's air-conditioning department. Mr. Carlson was formerly connected with the sales departments of the Victor Talking Machine Company, Boston, and the Charles H. Ditson Company, New York, attaining the position of sales manager of the latter organization.

William E. Umstattd has been elected president of the Timken Roller Bearing Company, Canton, Ohio, to succeed **H. H. Timken,** who becomes chairman of the board. Mr. Umstattd has been with the company since 1919. He has worked in all departments of the plant, having served as assistant superintendent, assistant factory manager and factory manager. In 1932 he was named executive vice-president and in that

capacity has had intimate contact with all activities of the company, including financial, selling, production and general company policies. **Henry H. Timken, Jr.,** was elected a vice-president of the Timken Roller Bearing Company and a vice-president of the Timken Steel & Tube Company.

OBITUARY

Samuel G. Dunham

Samuel G. Dunham, chairman of the board of directors of the Hartford Electric Light Company, a former president of it

and director for many years of large financial institutions in that city, died June 15, following a long illness. He was 84 years of age.

In 1881, in association with his brother, Mr. Dunham purchased the charter of the Hartford Light & Power Company, a steam power utility, which he reorganized and established as the Hartford Electric Light Company. The new company installed a street-lighting system of arc lights and later supplanted these with incandescent lamps. He was elected vice-president and a director of the Hartford Electric Light Company in 1900 and succeeded his brother, Austin C. Dunham, as president in 1912. Early in 1924 he resigned as president and was succeeded in office by Samuel Ferguson, who is president today.

Mr. Dunham became a director of the Dime Savings Bank in 1885 and a trustee of the Society for Savings in 1894. He was a director in the Aetna Casualty & Surety Company, the Automobile Insurance Company of Hartford, the Connecticut Power Company, the Smyth Manufacturing Company and the Taylor & Fenn Company. He succeeded his father after the latter's death in 1877 as a director of the Phoenix Bank and the United States Bank and as a trustee of the United States Security Trust Company.

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George T. Dewey, former president of the Worcester Electric Light Company, died June 5 at his Worcester, Mass., home. Mr. Dewey was 75 years of age. In addition to his utility interests, Mr. Dewey had been president of the Baldwin Chain & Manufacturing Company, vice-president of the Graton & Knight Manufacturing Company and treasurer of the Wright Wire Company.

Floyd E. Dellinger, overhead electrical engineer of the Los Angeles Gas & Electric Corporation, died at his home in Los Angeles, Calif., June 8. Mr. Dellinger, who was 54 years of age, had been a member of the Los Angeles Gas & Electric Corporation organization since 1909. He was a member of the Electrical Club and a past-chairman of the Los Angeles chapter of the American Institute of Electrical Engineers.

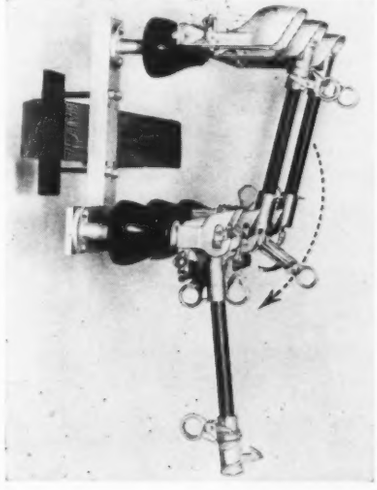
Daniel M. Bradley, for the past fourteen years chief engineer of the Taunton, Mass., municipal light department, died at Oak Bluffs, Mass., on June 7, after several weeks of failing health. He was 63 years of age. In his earlier career he served as assistant chief engineer of the Cambridge Electric Light Company and for eight years was employed by the Westinghouse Electric & Manufacturing Company and for seven years by the General Electric Company as an engineer in steam turbine erection.

Albert Homer Manwaring, retired electrical engineer and inventor, died last week at his home in Philadelphia, He was 75 years old. Mr. Manwaring was retired from the Philadelphia Electric Company, for which he worked for 47 years. He superintended the installation of the first arc lights in Philadelphia in 1881. His inventions included the broad carbon arc lamp and a plow for installing underground cables. He was president of the Philadelphia Electric & Manufacturing Company, which he founded in 1884. He was also a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Pennsylvania Academy of Fine Arts, the Manufacturers' Club and the Franklin Institute.

NEW EQUIPMENT

S. & C. Reclosure Cutouts

Cutouts for reclosing distribution lines within 30 cycles have been introduced by Schweitzer & Conrad, Inc., Chicago. "Semafor Reclosure" cutouts incorporate three S.&C. open type Semafor cutout fuse tubes so designed to give three reclosures before any fuse links must be replaced. They are for distribution service on voltages up to 15 kv., with maximum fuse ratings of 100 amp. They are for application on branch lines or inaccessible transformer locations where the service maintenance



Schweitzer & Conrad

is important and long outages must be prevented. The same fuse tube assembly as for Semafor cutouts is used, as already noted, and a terminal is provided on the lower end of the fuse tube to permit the use of expulsion type fuse elements. A rubber bumper takes up the impact when the tube drops to the open position. The tube can be removed from the ground with hook stick and the fuse link replaced on the job.

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White Paint Improved

Improvements in each of the five qualities of "Barreled Sunlight" white paint have been announced by the U. S. Gutta Percha Paint Company of Providence, R. I. It is whiter than before, to improve its light-reflecting properties, and will resist yellowing longer; it spreads further and "hides" better than previously, so fewer coats and less paint are required, and, lastly, it flows much easier, so a quicker job can be done. White paint made by the "Rice process" is said to remain white longer than any oil-gloss paint or enamel, domestic or foreign, applied under the same normal conditions and according to specifications.

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Refrigeration compressors in two types and two sizes, to augment its commercial refrigeration line, have been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The new units are 1 and 1½ hp. in capacity in both air- and water-cooled types. All four models are of vertical, two-cylinder, single-acting design with compressor block consisting of cylinders, crankcase and oil pump cast in one block. Valve-in-head construction is used, employing low inertia Swedish steel reed type valves which give the units a high volumetric efficiency. Shell-and-tube condensers are used on water-cooled models. Cooling coils of either

the natural or forced draft circulation type have been added to the line to meet all types and sizes of applications.

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Butt Flash Valve Welders

To meet the increased use of special alloy steels for motor valves, tappets, etc., the Taylor-Winfield Corporation, Warren, Ohio, has developed the type B-8-45 deg. butt flash welders. They permit these parts to be made by butt welding of two different alloy steels to place the desired alloy at each point in the finished assembly. The welders are designed for precision accuracy, for parts are usually machined before welding to very close limits. Proper welding heat, time and upset pressure are synchronized to give uniform results.

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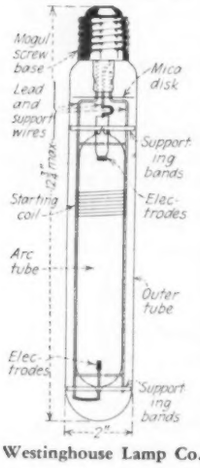
High-Pressure Lamps Introduced at Chicago



Westinghouse Lamp Co.

With the installation of 600 high-pressure mercury-vapor lamps in combined mercury vapor-tungsten filament lamp fixtures at the Ford Building at the 1934 Century of Progress the Westinghouse Lamp Company, Bloomfield, N. J., has introduced its units of this type. The lamps are rated at 15,000 lumens output with 400-watt consumption. Their design life is 1,500 hours and they are said to have an average lumen maintenance through life equal to 85 per cent of the initial lumen output.

The space between the inner and outer bulbs contains nitrogen at about one-half atmosphere pressure, which serves to conserve heat and to prevent arcing between the metal parts which hold the inner tube firmly in the main bulb. A small quantity of argon gas and several turns of wire wound around the inner bulb facilitate starting. Starting time is approximately twelve minutes. Two 400-watt high-pressure mercury-vapor lamps are used in conjunction with three 500-watt lamps to give approximately daylight illumination in the Chicago installation.

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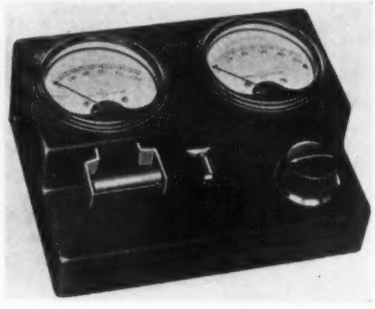
Locking connector body and flush receptacle for power cords have been announced by the merchandise department of the General Electric Company. Made of black "Textolite," the connector is designed so that it can only be removed by turning it a short distance to the left before pulling out. They are now used on G.E. refrigerators as a connection to the cold control.

Surge-Crest Ammeters of Simplified Design

Improved surge-crest ammeters for use with the recently introduced magnetic-link method of measuring the magnitude and polarity of lightning surge currents in transmission line structures are available from the General Electric Company, Schenectady. The ammeter for measuring the degree of magnetization of links sent in from the line is a



General Electric

combination of two indicating instruments in series with a flashlight cell and rheostat.

One of the instruments is a milliammeter, by which the current through the combination is read. The other is essentially a milliammeter, but without a magnet, so constructed that the magnetized link, when properly inserted, becomes the magnet of the instrument. When a given current flows through the combination the deflection of the special instrument depends on the degree of magnetization of the link and indicates directly the crest value of the lightning surge current. The meter is not sensitive to or affected by nearby magnetic materials, such as objects of iron or steel, or by stray magnetic fields.

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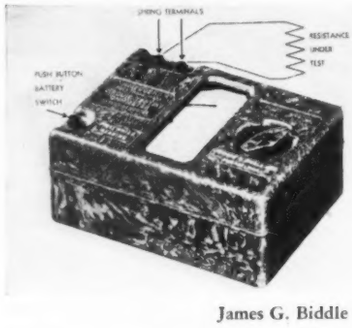
Circuit Testing Ohmmeters

For quick measurements of resistance from as low as a fraction of an ohm to as high as 200,000 ohms, Midget "Megger" circuit testing ohmmeters have been announced by the James G. Biddle Company, Philadelphia. The instru-



James G. Biddle Co.

ments are direct-reading and employ a "crossed coil" winding on the moving system so that readings are independent of battery voltage and no "zero" or other adjustments are necessary. Testing current is provided by a standard size 4½ volts dry cell. Four instruments each for two ranges are provided, which vary from 0 to 3 ohms to 100 to 200,000 ohms for the high range of the high-resistance meter. Cases are of synthetic resin, high polished and mottled green in color.

Instruments are applicable for a variety of testing from small fixed coils to insulation testing within their capacity. Spring terminals for testing leads are used. A push-button battery switch is used which can be mounted as shown or on one of the testing spikes available. Scales are individually calibrated and engraved.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Bon-Air Air Conditioning, bulletin of the Bon Air Radiator Corporation, 99 State Street, Boston, 10 pages. Describes with illustrations, sectional views and drawings the functions and features of Bon-Air Senior and Junior duct system home air conditioning equipment.

How to Select Insulated Cable, reference book GEA-1837 on insulated cable for transmission and distribution of electric power at normal frequencies of the General Electric Company, Schenectady, 80 pages, May, 1934. Covers the more usual applications of cable and describes the various types of insulation and finish. Tables of wire gages and dimensions, thicknesses of insulation, sizes of shipping reels, reactances and cable factors, and a bibliography for cable details are included.

Bakelite Synthetic Resins for Paints and Varnishes, booklet of the Bakelite Corporation, Bound Brook, N. J., 24 pages. A non-technical discussion backed by some simple tests to show the high quality of bakelite synthetic resins and to indicate the extremely wide variety of the resins available for the manufacture of specialized finishes.

Link-Belt Speed Reducer, Catalog No. 1415, Link-Belt Company, Chicago, Ill., 32 pages, June, 1934. Illustrated catalog with prices, horsepower and other engineering data, dimension diagrams, etc., covering single, double and triple reduction units of herringbone gear types, also a full line of flexible couplings.

Rotary Air Compressors and Dry Vacuum Pumps, Leaflet 2159-A of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., 4 pages, May, 1934. Illustrated leaflet with construction and dimension diagrams discussing the commercial advantages, construction and operation, and specifications of Allis-Chalmers Type "WS," single-stage, water-cooled compressors and dry vacuum pumps for pressures up to 60 lb. gage and vacuums up to 28.5 in. of mercury.